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ABSTRACT

This study investigated the effects of class size on the academic achievement of South Carolina's first grade students. Two classes within each of 25 school district units participated in the project. Within each of the school district units, 50 first grade students were randomly selected and assigned to the small class treatment group (class size=21 students) or the large class treatment group (class size=29 students). Two teachers within each school district unit were then randomly selected and assigned to one of the two treatment groups. Pre-testing in reading, mathematics, and language and post-testing in reading, mathematics, language, and overall achievement were done with the Comprehensive Tests of Basic Skills. In order to investigate possible confounding variables, data were also collected on student sex, race, Title I classification and kindergarten experience. Findings showed that class size did not have a significant effect on the reading, mathematics, language, or overall achievement of the first grade students involved in the project. A summary of the South Carolina First Grade Pilot Project 1975-76 is also included. (JMB)

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South Carolina First Grade Pilot Project 1976-77: The Effects of Class Size on Reading and Mathematics Achievement

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Cyril B. Busbee, State Superintendent

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SOUTH CAROLINA FIRST GRADE PILOT PROJECT 1976-77:

THE EFFECTS OF CLASS SIZE ON

READING AND MATHEMATICS ACHIEVEMENT

A Joint Effort of the

Division of Administration and Planning
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Columbia, South Carolina
January, 1978

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SOUTH CAROLINA FIRST GRADE PILOT PROJECT 1976-77: THE EFFECTS OF CLASS SIZE ON READING AND MATHEMATICS ACHIEVEMENT

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PREFACE

The South Carolina First Grade Pilot Project was initiated in 1975-76 by the South Carolina Legislature for the purpose of assessing the impact of reducing the pupil/teacher ratio on student achievement in the State's first grade classrooms. The project was refunded by the Legislature for the second consecutive year in the South Carolina General Appropriations Act for the Fiscal Year 1976-77, Section 31, Item IV-B. Funds in the amount of $250,000 were appropriated for the project. The major portion of these moneys was provided to the participating districts for the funding of one additional first grade teacher.

The Office of Research, Division of Administration and Planning, was responsible for the development of the research design, the implementation of the design, and the evaluation of the project data. The Office of General Education, Division of Instruction, assisted the Office of Research in the implementation of the Research design and was responsible for coordination of the funds distribution to the local school districts.

In this report, the methodology and results of the South Carolina First Grade Pilot Project 1976-77 are presented. A summary of this study is provided in the South Carolina First Grade Pilot Project: The Effects of Class Size on Reading and Mathematics Achievement, Summary, Office of Research, January, 1978. The results from the first year of the project are included in the South Carolina First Grade Pilot Project 1975-76: The Effects of Class Size on Reading and Mathematics Achievement, Office of Research, January, 1977.

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ABSTRACT

The primary purpose of the South Carolina First Grade Pilot Project 1976-77 was to examine the effects of class size on the reading and mathematics achievement of first grade students. The secondary purpose was to examine the effects of class size on the language and overall achievement of first grade students. For the purpose of investigating the effects of class size on student achievement, two treatment groups were used: a small class size group (experimental group) and a large class size group (control group). The small class size was 21 students; whereas, the large class size was 29 students. Two classes within each of 25 school district units participated in the project. Within each of the 25 school district units, 50 first grade students were randomly selected and assigned to the small class treatment group or the large class treatment group. Two teachers within each school district unit were then randomly selected and assigned to one of the two treatment groups (the small class or the large class).

In September of 1976, the mean small class size was 20.9; and the mean large class size was 28.7. In May of 1977, the mean small class size was 20.5; and the mean large class size was 28.1.

A summary of the findings with respect to the effects of class size on the reading achievement, mathematics achievement, language achievement, and overall achievement of first grade students follows.

1. The reading achievement of first grade students in small classes was not significantly different from the reading achievement of first grade students in large classes.

2. The mathematics achievement of first grade students in small classes was not significantly different from the mathematics achievement of first grade students in large classes.
3. The language achievement of first grade students in small classes was not significantly different from the language achievement of first grade students in large classes.
4. The overall achievement of first grade students in small classes was not significantly different from the overall achievement of first grade students in large classes.

In general, class size did not have a significant effect on the reading, mathematics, language, or overall achievement of the first grade students involved in the project. Nevertheless, for all four achievement measures, the amount of increase in achievement favored the small classes. This increase, however, was not sufficient to be considered a "real" increase and, thus, would be considered a chance increase.

CHAPTER I

NATURE OF THE INVESTIGATION

Introduction

Educators are constantly searching for interventions which could result in higher student learning as measured in terms of student achievement. In recent years, much attention has focused on the question: Does class size have a significant effect on student learning?.

As noted in the Research Summary 1968-S1, Class Size (1968), published by the National Education Association, there have been many divergent opinions on class size:

> Herodotus reportedly made reference to 'classes of thirty'. Many centuries later Comenius stated that 'it is not only possible for one teacher to teach several hundred scholars at once, but it is also essential, since for both the teacher and students it is by far the most advantageous system'. In contrast, John Locke, who was about 39 years old when Comenius died, thought that 'it is impossible that the master shall have fifty or an [sic] hundred scholars--nor can it be expected that he instruct them properly in other than their books'.
>
> Such divergent opinions came from educational philosophers and practitioners prior to 1839--when J. M. Rice reported the first 'modern' research study on class size...(p. 5).

A 1944 study by Frank J. Manley, assistant superintendent of the public schools of Flint, Michigan, and director of the Mott Foundation, was a continuation of the more "modern" class size research initiated earlier by Rice. Two additional teachers were added to the staff of one of the elementary schools reducing the pupil/teacher ratio from

37:1 to 30:1. The results of the study indicated that reducing the pupil/teacher ratio resulted in higher fourth and sixth grade student achievement, student attendance, student classroom behavior, and professional morale (Lundberg, 1947).

Presently, both teachers and school administrators contend that a reduction in class size would result in increased student learning. This improved student learning would be a consequence of the additional time each teacher would have available to spend with the individual student, as well as a consequence of improved student and teacher attitudes toward the learning situation. The following remarks made by teachers in the Atlanta school system support this position regarding reducing class size (Perrimon, Bowen, Payne, & Johnson, 1976):

> I am a sixth grade teacher at the Woodson Elementary School in Atlanta, and I have 39 students. The preceding afternoon, three children in my classroom asked for special help. I told them to wait, that I was working with some others but would be with them in a few minutes. Those few minutes never came...I was simply unable to spread myself thin enough to attend the needs of all my 39 children (p. 39).

> My principal often tells me, 'you're one of my best teachers; I know you can handle it.' What he's referring to is the large number of children I have in my classroom. Sure, I can 'handle' them. I could handle three times as many, and so could most teachers. But handling children is not what teaching is all about (p. 40).

> Now, after several years of teaching and of talking with and observing other teachers, I realize that all of us are crowding in sheer numbers of students. The only alternative to having fewer students is to lower your goals - and many teachers have done this (p. 42).

In addition to being a concern of the educator, class size is also a concern of the layman because of the financial aspect. For example, suppose a school district with an average elementary class size of 30 students wishes to reduce the number of students in each class by 10 to obtain an average elementary class size of 20. Since the average class size would be reduced by a factor of one-third, the district budget allocated to teachers' salaries would have to be increased by a factor of one-third.

A financial perspective of the class size issue in South Carolina is given in the following illustration. In South Carolina, there were 43,064 first graders, 36,636 second graders, and 35,228 third graders enrolled in the State's self-contained public school classrooms during the School Year 1976-77 (South Carolina State Department of Education, April 6, 1977). The pupil/teacher ratios for Grades 1, 2, and 3 were 26.2 to 1, 26.5 to 1, and 26.9 to 1, respectively, for the School Year 1976-77 (South Carolina State Department of Education, April 12, 1977). The 1976-77 estimated average State aid salary paid for academic positions (which includes guidance counselors, librarians, teachers, and other instructionally-oriented staff) was $8,901 (South Carolina State Department of Education, February, 1977). Although the amount of $8,901 is computed on the basis of all instructionally-oriented personnel and not teachers only, this amount was used as an <u>estimate</u> of the average teacher's State aid salary in determining the expenditures for teacher salaries referenced.

Using these data, the amount of $38,612,538 was obtained as the 1976-77 <u>estimated</u> total State expenditure for teacher salaries in

Grades 1 through 3. Reducing the pupil/teacher ratio by one student statewide in Grades 1 through 3 would mean a budget increase of approximately $1,504,269 (or a budget increase of 3.7%) to finance new teaching positions. In contrast, reducing the pupil/teacher ratio to 20 to 1 in each of the first three grades would mean a budget increase of approximately $12,550,410 (or a budget increase of 24.5%). In view of these financial consequences, the question then becomes: how much of an improvement in student learning or achievement would be sufficient to warrant the additional expenditure of funds required?.

Because of the potential educational and financial ramifications of reducing class size, the South Carolina Legislature deemed necessary a pilot project concerned with the investigation of the effects of class size on South Carolina student achievement. First grade students in the State were selected as the subjects of the investigation since the first grade would be a logical starting point for concentrating funds to reduce class size on a statewide basis.

The South Carolina First Grade Pilot Project was originally funded for the School Year 1975-76. The project was refunded for the School Year 1976-77. In this report, the methodology and results of the 1976-77 project are presented.

Purpose of the Study

The primary purpose of this study was to investigate the effects of class size on the reading and mathematics achievement of South Carolina's first grade students. The secondary purpose of this study

was to investigate the effects of class size on the language and overall achievement of South Carolina's first grade students. More specifically, this study attempted to provide answers to the following four research questions:

1. What effect does class size have on the reading achievement of first grade students?;
2. What effect does class size have on the mathematics achievement of first grade students?;
3. What effect does class size have on the language achievement of first grade students?; and
4. What effect does class size have on the overall achievement of first grade students?.

Review of the Literature

The results of the research investigating the effects of class size on student achievement fall into three major categories. The first category contains studies in which class size did not make a difference in student achievement. The second category contains studies in which the achievement of students in large classes was higher than the achievement of students in small classes. The third category contains studies in which the achievement of students in small classes was higher than the achievement of students in large classes.

Studies in Which Class Size Did Not Make a Difference

There is support in the literature for the view that class size does not make a difference in student achievement. In 1973, the report What Research Says About Improving Student Performance: A Manual for Administrators was published by the New York State Department of Education in an attempt to identify general trends in research related to improving student academic performance. In 37% of the 19 studies reviewed, class size was significantly related to what was referred to as the "ability of schools to educate students" (p. 12). In the non-cognitive area, class size was not a significant factor in any of the four studies reviewed. Although class size did appear to be a significant variable in approximately 42% of the 12 studies reviewed in the cognitive area, this evidence was not strong enough to warrant support for the contention that class size is a significant determinant of student academic success.

The Division of Research and Development of the Cleveland Public Schools in Ohio conducted a three-year (1970-72) longitudinal study, the "More Effective Schools Program (MES)", which was designed to improve poor achievement across all grades in a given school (Taylor & Fleming, 1972). The MES classes were characterized by an increase in individualization of instruction accomplished by reducing the average class size in participating schools to 25 students and by implementing several instructional improvements. The reading and mathematics subtests of the Stanford Achievement Tests were used to measure achievement in these content areas.

The project data were analyzed longitudinally for three groups of students over a period of three years: 1970, 1971, and 1972. In the Grade 1-2 Group, the performance of first grade children who entered the MES Program in 1971 (Year 2 of the program) was compared with the performance of these same children as second graders in 1972. In the Grade 2-3-4 Group, the performance of second grade children who entered the MES Program in 1970 (Year 1 of the program) was compared with the performance of these same children as second graders in 1971 and with the performance of these same children as third graders in 1972. In the Grade 4-5-6 Group, the performance of fourth grade children who entered the MES Program in 1970 was compared with the performance of these same children as fifth graders in 1971 and with the performance of these same children as sixth graders in 1972. Since the results of the longitudinal analyses were based only on those students who remained in the study over the three-year period, the results may have been biased.

In 1972 (Year 3 of the program), the reading performance of the sixth graders in the MES classes was significantly higher than the reading performance of the sixth graders in the control classes for the Grade 4-5-6 Group. Whereas in 1971 (Year 2 of the program), significant differences in fifth grade performance favoring the MES classes had occurred for both reading and mathematics.

In 1972, the mathematics performance of second graders in the MES classes was significantly higher than the mathematics performance of second graders in the control classes for the Grade 1-2 Group. However, no significant differences favoring the MES classes occurred for either the Grade 2-3-4 Group or the Grade 4-5-6 Group in mathematics. For

the Grade 2-3-4 Group, the mathematics performance of the fourth graders in the control classes actually was significantly higher than that of the fourth graders in the MES classes. Thus, class size in conjunction with other factors that were thought to affect achievement did not appear to make a consistent difference over time in the reading and mathematics achievement of this sample of students.

Studies Favoring Large Class Size

Support for the position favoring large class size is evidenced in a study by Madden (1968) in which the effect of class size on ninth grade mathematics achievement was examined. The Contemporary Mathematics Test, Junior High School Level, was administered to large classes containing 75 to 85 students and to small classes containing 25 to 40 students. Based on his analysis, Madden concluded that ninth graders in large classes performed significantly higher in general mathematics than students in small classes and, furthermore, that ninth graders of average ability in large classes performed significantly higher in general mathematics than ninth graders of average ability in small classes.

In a more recent study, Irving Flinker (1972) examined the effects of class size on the mathematics and English achievement of seventh grade students. Three classes of seventh grade students at George Gershwin Junior High School 166 in Brooklyn, New York, were involved in the study. The students were ranked according to their performances on the Metropolitan Achievement Test in Reading, Form BM, and then assigned to one of three classes so that the three classes would be matched on student reading ability. One class contained 55 students, and the

other two classes contained 34 students each. Additionally, an attempt was made to match the classes on course content and quality of instruction. Forms A and B of the Metropolitan Achievement Test in Mathematics were administered in October, 1970, and June, 1971, respectively. The same form of the New York State Junior High School Survey Test in English was administered in January, 1971, and June, 1971, respectively. On the basis of his results, Flinker concluded that the large class size in the seventh grade was conducive to the development of mathematics and English skills. Flinker acknowledged two extraneous variables in his study that could have influenced his results. First, the teacher of the large class was also head of the mathematics department in the school; and, second, the teacher of the large class received assistance from a paraprofessional. Because of the quality of instruction present in the large class, Flinker conjectured that having an excellent teacher in a large class tended to produce higher results than having an average teacher in a small class. Since the design of Flinker's study did not adequately control for quality of instruction and paraprofessional assistance, the results observed could not be attributed to the effects of the class size variable alone.

Studies Favoring Small Class Size

There are several studies which support the contention that small class size is significantly related to student achievement. One of the earlier and most comprehensive studies is a five-year (1959-64) study conducted by Furno and Collins (1967). Furno and Collins investigated the relationship between class size and the reading and mathematics

achievement of third grade students. In 1959, data were collected on 16,449 third graders in the Baltimore public schools. These students were grouped by class size into four class size categories: 25 or less, 26 to 31, 32 to 37, and 38 or more. The Metropolitan Elementary Reading and Arithmetic Tests, Stanford Elementary Reading and Arithmetic Tests, and Stanford Intermediate Reading and Arithmetic Tests were used to assess gains in achievement over the five-year period. Seventy-eight percent of the comparisons favored students in smaller classes. Nonwhite students seemed to benefit more from the smaller class size than white students. In 66% of the comparisons between larger and smaller class achievement gains, the comparisons favored the nonwhite students. Murphy (1975) in his review of the literature agreed that in general the study favored the smaller class sizes; however, he observed that the achievement comparisons of class size groups of 25 or less with class size groups of 26 to 31 were not as definitive. He noted that 10 comparisons for reading and arithmetic favoring the smaller class size group were derived from white students in the two lowest intelligence groups (IQ's of 79 and below and IQ's of 80 to 94). For the total reading and arithmetic comparisons for white students with IQ's of 95 and above, one comparison favored the smaller group, three comparisons favored the larger group, and four comparisons favored neither group. Murphy concluded:

> It seems reasonable to suspect, therefore, that differences in achievement between class size groups of 25 [or less] and class size groups of [26 to] 31 are attributable more to differences in intelligence than differences in class size (pp. 24, 26).

Balow (1969) also conducted a longitudinal study in which the results favored small class size. Balow observed the reading achievement of the same sample of students from Grade 1 to Grade 4. For a period of two or more years, students in class sizes of 15 scored significantly higher in reading achievement than students in class sizes of 30. Balow concluded that a positive relationship between small class size and student reading achievement existed when a given sample of students remained in small classes over a period of two or more consecutive years. He speculated that class size was critical to reading in the first grade because learning patterns had not been established; however, by the third grade, the advantages of class size were negated by differences in individual learning patterns.

Additional support for the position favoring small class size was reported by Woodson (1968) in a study in which the overall class size policy for 95 school districts was compared with the achievement of students in Grades 4 through 6. Residual scores, the difference between an actual score on a standardized test and a score predicted from an intelligence test, were used as the measures of achievement. Woodson used correlational analyses in obtaining the following results:

1. The relationship between class size and student achievement was not consistent for pupils with different academic abilities. Significant correlations, which existed only for low ability students (Otis Lennon IQ's of 85 or less), indicated that an inverse relationship existed between the achievement of low ability pupils and class size. This evidence was not sufficient to conclude

that "the scholastic achievement of the lower ability pupil was influenced to a greater extent by the size of the class in which he studied than was the achievement of the student of higher academic potential" (p. 3).

2. The correlations indicated that there was generally no significant relationship between class size and reading or mathematics achievement.
3. The mean scores of students in districts in the lower third of the class size range were higher; however, significant differences between mean scores were observed only in the fourth grade.

Murphy (1975) presented several problems that existed in this study. First, the findings were not generalizable because the sample of school districts was not randomly selected. Second, the teacher variable was not controlled. Third, districts with class sizes of 22 students might possess characteristics which are different from the characteristics of districts with class sizes of 27 students.

Olson (1971) found in a recent study that class size was important to overall success in the classroom. In reference to Olson's study, the following statement was made in Phi Delta Kappan:

> At last a researcher with impeccable credentials claims unqualified answers to certain perennial questions (p. 63).

Olson's study was noteworthy in that educational quality was measured by classroom processes and not by student performance on a standardized test. This study extended the research of Bernard McKenna (which was conducted 14 years earlier in 1957) to almost 20,000 classrooms across

the country. The major intent of the Olson study was to answer some of the major questions that have been of concern to educators. One of the questions that he attempted to answer in his study was: "What effects do class sizes of 5, 15, 25, and 36 have on educational quality in the classroom?" (p. 63). One hundred and twelve school districts located in 11 large northern and midwestern metropolitan areas participated. Olson used Indicators of Quality, which has been demonstrated to be highly reliable and valid for measuring the overall quality of the classroom educational process. The indicators assessed classroom processes on the basis of four criteria: individualization, interpersonal regard, group activity, and creativity. Observation teams using standardized forms visited classrooms in order to measure the classes on these four criteria. Olson found that class size was one of the variables observed to be highly predictive of the quality criterion. He further found that smaller class sizes were consistently and significantly related to the quality criterion. Olson concluded:

> With little question, it would be well for school systems to consider altering their class size ratios if close to and on the wrong side of a critical breakpoint, such as 26-1 ratio in elementary, or 16-1 in secondary. However, to expend school funds to lower just any existing ratio by one or two students seems unjustified in view of this evidence (pp. 64-65).

Olson defined critical breakpoint as that point at which there was a drop in scores on the quality criterion between class sizes, for instance, between a class size of five and under and a class size of five to ten. Olson noted that, since the selection of the sample was nonrandom, the results were only generalizable to the population under

investigation. Nevertheless, he noted that the findings should be operationalized to other public school systems for the purpose of discussion and further investigation. In most class size research, student achievement as measured by a standardized test is used as the single indicator of quality; however, in this study, achievement on a standardized test was not included as one of the indicators of classroom quality.

In a review of the literature, Olson and McKenna (1975) found further evidence to support their findings on the positive effects of small class size. On the basis of their review, Olson and McKenna made the following generalizations which support the contention that small class environments are conducive to learning:

1. Teachers employ a wider variety of instructional strategies, methods, and learning activities and are more effective with them (p. 1).
2. Students benefit from more individualized instruction (p. 1).
3. Students engage in more creative and divergent thinking processes (p. 2).
4. Students learn how to function more effectively as members and leaders of groups of varying sizes and purposes (p. 2).
5. Students develop better human relations and have greater regard for others (p. 2).
6. Students learn the basic skills better and master more subject matter content (p. 2).
7. Classroom management and discipline are better (p. 2).
8. Teacher attitudes and morale are more positive (p. 2).
9. Student attitudes and perceptions are more positive (p. 2).

These generalizations were based on a review of approximately 60 studies. The authors did point out that in some of the studies there was little difference between the definitions of large and small classes. However, the authors concluded that "for a great range of important educational goals and processes, reflected in the generalizations, fewer is unquestionably better than more" (p. 1).

In one of the most recent studies, Moody, Baussel, and Jenkins (1973) obtained results that definitely favored a reduction in class size. The study was experimental in that the class size variable was manipulated by the researchers. Eighty-three fourth grade students were randomly selected to participate in the study from each of the three public schools in a Northern Delaware school district for a total of 249 subjects.

Within each of the three schools, the 83 students were randomly assigned to one of four treatment groups. The four treatment groups consisted of four different instructional techniques each of which was designed for teaching a common set of 10 mathematics objectives. Three of the groups contained 20 subjects, while the fourth group contained 23 subjects. In Group 1-1, each student was instructed individually by one teacher for a total of 20 instructional trials. In Group 1-2, two students were instructed simultaneously by one teacher for a total of 10 instructional trials. In Group 1-5, five students were instructed simultaneously by one teacher for a total of four instructional trials. In Group 1-23, all 23 students were instructed simultaneously by one teacher for a total of one instructional trial.

Regardless of the teacher/pupil ratio, each trial lasted 30 minutes. The teachers in the study were volunteer junior and senior elementary education majors. Although the teachers were not randomly assigned to schools, the teachers were randomly assigned to a particular treatment group. The pretest and posttest consisted of 20 items designed to measure the 10 mathematics objectives. The mathematics achievement for Group 1-1 was superior to the mathematics achievement of the other three treatment groups. There was no difference in mathematics achievement observed between Group 1-2 and Group 1-5. However, both Group 1-2 and Group 1-5 were significantly superior to Group 1-23 in terms of mathematics achievement. The authors concluded that a reduction in class size did make a difference in mathematics achievement when the class size was reduced from an average class size standard.

The results of the 1972 National Education Association (NEA) Opinion Poll indicated that 60 percent of the teacher respondents rated "working with too many students each day" in the category "moderate, serious, or critical problem". In the 1975 NEA Opinion Poll, teachers again expressed concern about class size. In the questionnaire teachers were asked, "If you could make one change that you think would improve your own morale or professional satisfaction as a teacher, what would the change be?". Lower class size was the second most frequent response given by the teachers, and approximately 11 percent of the teachers selected this response.

Conclusion of the Literature Review

Many studies have been conducted to assess the effects of class size on student achievement; however, to date the research has been inconclusive. The general sentiment in the literature is that there is no ideal class size that can be globalized to all subjects, grade levels, and modes of instruction. On the contrary, class size is considered to be situation-specific, for in some cases, a large class size results in higher achievement levels than a small class size. In spite of the fact that research on class size has not yielded conclusive results, many educators still contend that class size is a critical problem. Given the research to date, the most appropriate approach to the class size question was to conduct a study in South Carolina and attempt to control variables that could influence student achievement.

Summary of the South Carolina First Grade Pilot Project 1975-76

The South Carolina First Grade Pilot Project 1975-76 examined the effects of class size on the reading and mathematics achievement of first grade students attending schools in 23 of the 92 public school districts. There were 50 project classes matched on racial composition of the student body, socioeconomic background of the students, and school curriculum. Each pair of classes contained one experimental class (referred to as the small class) and one control class (referred to as the large class). The average small class size was 19.9 students, and the average large class size was 26.7 students. Approximately, one-half of the project teachers received in-service training. Both the experimental and

control class teachers for a given pair of classes either received in-service or did not receive in-service.

The questions of primary interest concerned the effects of class size, teacher in-service training, and the interaction of class size and teacher in-service training on reading and mathematics achievement. The findings with respect to the effects of class size on reading achievement revealed that the reading achievement of first grade students in small classes was significantly higher than the reading achievement of first grade students in large classes. Although the amount of increase in scale score points for reading achievement was small, this increase was sufficient enough to be considered a "real" increase rather than a "chance" increase.

In mathematics, however, the difference between the achievement of first graders in small classes and the achievement of first graders in large classes was so small that these differences might have been the result of chance alone.

Although some teachers attended special in-service training sessions during the year, there was no evidence that in-service training alone affected the achievement of first grade students in reading or mathematics.

There was evidence that the combination of class size with teacher in-service training had an effect on the reading achievement of first graders. Students in large classes whose teachers received in-service training, students in small classes whose teachers did not receive in-service training, and students in small classes whose teachers received in-service training scored significantly higher than students in large

classes whose teachers did not receive in-service training. There was no evidence that any one combination of class size and teacher in-service training affected mathematics achievement more than the other possible combinations.

Additional questions concerning the effects of class size, teacher in-service training, and the interaction of class size and teacher in-service training on language and overall achievement were explored.

The results from the language achievement analyses indicated that class size, teacher in-service training, and the interaction of class size and teacher in-service training did not significantly affect the language achievement of first grade students.

The results from the overall achievement analyses indicated that the overall achievement of first grade students in small classes was significantly greater than the overall achievement of first grade students in large classes. However, neither teacher in-service training nor the interaction of class size and teacher in-service training had any significant effects on overall achievement.

In general, the pilot project demonstrated that reading achievement and overall achievement of first graders increased as a result of reducing class size.

Hypotheses

The following hypotheses were formulated for the investigation of the 1976-77 project data:

Hypothesis I: There will be no significant difference in the reading achievement of first grade students in small classes and the reading achievement of first grade students in large classes.

Hypothesis II: There will be no significant difference in the mathematics achievement of first grade students in small classes and the mathematics achievement of first grade students in large classes.

Hypothesis III: There will be no significant difference in the language achievement of first grade students in small classes and the language achievement of first grade students in large classes.

Hypothesis IV: There will be no significant difference in the overall achievement of first grade students in small classes and the overall achievement of first grade students in large classes.

CHAPTER II

PROCEDURES AND METHODOLOGY

Introduction

The purpose of this chapter is to discuss the procedures and methodology used in the implementation of the project design. The chapter is divided into four major sections. In the first section, a general outline of the time schedule for major project activities is given. In the second section, the procedures used in selecting the project students and teachers and in assigning the students and teachers to the two treatment groups are described. In the third section, the 13 variables used in the investigation of the project data are defined. In the fourth section, the research design of the study is discussed.

Overview of Project Activities

The Educational Assessment Section, Office of Research, was responsible for coordinating the project at the State level and developing and implementing the research design. The Curriculum Section, Office of General Education, assisted the Educational Assessment Section in implementing the project design. Activities involved included testing the first grade students, conducting in-service workshops, analyzing the project data, and documenting the project methodology and findings. Within each of the participating districts, a District Project Coordinator was appointed by the District Superintendent to be responsible for

coordinating the project at the district level. The primary activities of the District Project Coordinators included communicating project activities to the project teachers and organizing the pretest and posttest administrations.

In August of 1976, letters were mailed to the District Superintendents of those districts which had participated in the 1975-76 project. The purpose of this letter was to invite those districts to again participate in the 1976-77 project. Enclosed with this letter were the "Guidelines for the Selection of Schools, Students, and Teachers" (see Appendix A) and the "School Procedures Documentation Form" (see Appendix B).

In September of 1976, the Office of Research conducted three regional workshops to provide the project teachers with the instructions to be followed in administering the standardized tests necessary for the pretesting and posttesting. These workshops were conducted on September 8, 1976; September 9, 1976; and September 14, 1976. The actual administration of the pretest took place on September 21, 22, and 23, 1976.

Three in-service workshops were conducted during the period between the administration of the pretest and the administration of the posttest. These workshops were conducted on November 8, 1976; January 24, 1977; and February 25, 1977. The actual administration of the posttest took place on May 3, 4, and 5, 1977.

Sampling Procedures

The procedure used in the selection of the project sample for the 1976-77 project was basically the same as the one used in the selection

of the sample for the 1975-76 project. The sample selection proceeded in three stages. In the first stage, the districts were selected; in the second stage, the schools were selected within each district; and, in the third stage, the students were selected within each school.

The Office of Research was responsible for the selection of districts; however, within each district selected, the District Project Coordinator was responsible for selection of the schools and students in accordance with the "Guidelines for the Selection of Schools, Students, and Teachers" (see Appendix A for a copy of the Guidelines). If the district deviated from any one of these guidelines, the District Project Coordinator documented these deviations on the "School Procedures Documentation Form" (see Appendix B for a copy of the Documentation Form).

District Selection

The first stage of the sampling procedures involved determining those districts that would participate in the 1976-77 project. The same 25 districts that met the criteria for participation in the 1975-76 project were invited to participate in the 1976-77 project. The Office of Research and the Office of General Education originally selected these 25 districts from a group of 33 districts as a result of a comparison of the 33 districts on the following characteristics:

1. number of buildings containing 50 or more first graders;
2. number of buildings with space available for one or more additional classrooms;
3. number of classrooms for which necessary local funds were available;

4. number of buildings with experimental programs or research activities;

5. number of buildings that included team teaching;

6. number of buildings with ungraded programs;

7. number of first grade students based on 1973-74 180-day enrollment and Fall 1975 enrollment data;

8. number of white first graders and number of nonwhite first graders based on 1973-74 180-day enrollment and Fall 1975 enrollment data; and

9. geographic location.

Although the selection of these districts was nonrandom because of practical limitations, the 25 districts were considered to be a representative cross-section of South Carolina school districts in terms of district enrollment and geographic location.

Two of these 25 districts were unable to comply with the requirements of the 1976-77 evaluation design and were not included in the project. Therefore, twenty-three of South Carolina's 92 public school districts participated in this year's project.

School Selection

The school selection was necessarily restricted by four criteria specified in the Guidelines, Part I (see Appendix A). These criteria were concerned with school enrollment, available classroom space, commitment to the evaluation design, and availability of local funds. The school selection was also contingent upon the ability of those schools participating in Title I Programs to meet federal regulations

regarding racial distributions and paraprofessional assistance without violating any requirements of the research design. The requirements of particular concern were the simple random sampling procedures and the non-utilization of paraprofessional assistance. Thus, the school selection, as was the case for the district selection, was necessarily non-random because of practical limitations. Problems in school selection were resolved jointly by Office of Research Staff and district personnel. Schools documented any problems encountered in the school selection on the Documentation Form, Part I (see Appendix B).

Each of the districts which agreed to participate in the 1976-77 project was requested to select one school to participate in the project with the understanding that two project classes would be housed in that school. In 20 of the 23 districts, the two project classes were housed in the same school.

In three districts, the number of project schools selected in these districts varied. Because situational factors prohibited housing the two project classes in the same building in one district, the project classes were located in two separate schools that were similar in background. In an attempt to achieve representativeness with respect to district size, the decision was made to select two project schools within each of the two largest districts for a total of four project schools. Therefore, within each of these four schools, there was one pair of project classes. In the data analysis, these two large districts were considered to constitute four school district units, with each of the four district units containing one pair of project classes each.

Consequently, for data analysis purposes, although the sample consisted of 23 actual South Carolina school districts, the sample was considered to consist of 25 district units; that is, the 20 actual school districts consisting of one school each, the one school district consisting of two project schools, and the four artificial school district units created from the two largest districts.

Student Selection

The third stage of the sampling procedure involved the selection of the first grade students within each district and school who would participate in the project. Fifty students were to be selected within each school according to the simple random procedure which is specified in the Guidelines, Part II, Section A (see Appendix A). Those students who were eligible to participate were restricted to non-special education first grade students who had pre-enrolled for the School Year 1976-77. Students were required to have pre-enrolled so that they could be assigned to classes prior to the first day of school. This eligibility criterion posed a general problem because in many cases there was not enough information on the first grader to identify him or her as a special education student. As special education students were identified, they were to be removed from the project class and replaced by available new students. Procedures for replacing these students and other students who transferred from the project classes are specified in the Guidelines, Part II, Section C (see Appendix A). If there were any deviations in the student selection procedures, these deviations were documented by the District Project Coordinator on the Documentation

Form, Part II (see Appendix B).

Sixteen of the 25 district units indicated that they had followed the student selection procedures. The remaining seven district units indicated that they basically used the procedure specified with slight modifications. In two of the seven district units, non-special education first grade students who would require paraprofessional help as part of the ESEA Programs or Title I Programs were removed from the pool of eligible first grade students. The procedures specified in the Guidelines were then followed. In the other five of the seven district units, the eligible first grade students were first stratified by race and/or sex and/or ability, then a random procedure was used to select students. Since the student selection was random for all 25 of the school district units, no district unit was eliminated from the analysis as a result of deviation in the sampling procedure.

The total number of first grade students originally selected to be in the project was 1,239; and the total number of students in the project classes at the end of School Year 1976-77 was 1,214. During the course of the school year, 90 students were transferred out of project classes; and, of these 80 students, 58 students were replaced by other non-special education first grade students. Therefore, at the end of the school year, one thousand one hundred and fifty-nine of the 1,239 first graders originally selected remained in the project. The actual analysis of the project data, however, was based on fewer than 1,159 students as a result of editing procedures employed. In Chapter III, the data analysis editing procedures are explained; and the sample sizes for the

various analyses are given.

Student Assignment to Treatment Groups

The 50 first graders selected within each school district unit were randomly assigned to one of two treatment groups, an experimental class or a control class. Twenty-one of these 50 first graders were assigned to the experimental or small class, and twenty-nine of these 50 first graders were assigned to the control or large class. The assignment of the first graders was accomplished by means of the procedures specified in the Guidelines, Part II, Section B (see Appendix A). Districts documented any deviations in student assignment procedures in the Documentation Form, Part II (see Appendix B). Within each of the 25 school district units, there were one experimental class and one control class for a total of 25 experimental classes and 25 control classes. In other words, there were 25 class pairs.

The number of first graders in the 25 experimental classes was 522 at the beginning of the school year and 514 at the end of the school year including replacement of students. During the year, thirty-one of the original 522 students transferred out of the experimental classes; and twenty-three were replaced. Therefore, at the end of the school year, there were 491 (522-31) first graders in the experimental classes who were originally selected to be in the project.

The number of first graders in the 25 control classes was 717 at the beginning of the school year and 703 at the end of the school year including replacement of students. During the school year, forty-nine of the original 717 students transferred out of the control classes;

and thirty-five were replaced. Therefore, at the end of the school year, there were 668 (717-49) first graders in the control classes who were originally selected to be in the project.

Table 1 reveals the number of first grade students in each of the two project classes within each of the 25 class pairs for the beginning of the school year (September, 1976) and for the end of the school year (May, 1977). In September of 1976, the mean experimental class size was 20.9; the mean control class size was 28.7; and the mean difference between the two classes in each of the pairs was 7.8. In May of 1977, the mean experimental class size was 20.5; the mean control class size was 28.1; and the mean difference between the two classes in each of the pairs was 7.6.

Teacher Selection and Assignment to Treatment Groups

Within a given school, after the students had been selected and assigned to treatment groups, two project teachers were then selected and assigned to teach either the small class or the large class. All teachers who were under contract to teach the first grade for the School Year 1976-77 were eligible to be selected in the project. There were 50 project teachers selected, twenty-five of which were assigned to the small classes and twenty-five of which were assigned to the large classes. In six school district units, the same two teachers that participated in the 1975-76 project also participated in the 1976-77 project. The selection and assignment of the first grade teachers to the project classes was accomplished by the simple random selection procedures outlined in the Guidelines, Part III, Sections A and B (see

Table 1

Control Class Size (C) and Experimental Class Size (E)
for Each of the 25 Pairs of Project Classes

Class Pair	September, 1976			May, 1977		
	C	E	(C-E)	C	E	(C-E)
1	29	21	8	27	21	6
2	29	21	8	29	21	8
3	29	21	8	29	21	8
4	29	21	8	28	21	7
5	29	21	8	26	20	6
6	27	21	6	27	20	7
7	29	21	8	29	21	8
8	29	21	8	29	21	8
9	29	21	8	30	21	9
10	29	21	8	28	21	7
11	29	21	8	28	21	7
12	29	21	8	29	21	8
13	29	21	8	29	21	8
14	26	20	6	25	19	6
15	28	20	8	27	18	9
16	29	21	8	29	21	8
17	29	21	8	27	22	5
18	27	20	7	25	18	7
19	29	21	8	28	21	7
20	29	21	8	29	21	8
21	29	21	8	29	18	11
22	29	21	8	29	20	9
23	29	21	8	28	21	7
24	29	21	8	29	21	8
25	29	21	8	29	21	8
M	28.7	20.9	7.8	28.1	20.5	7.6

Appendix A). Districts documented any deviations from the teacher selection and assignment procedure in the Documentation Form, Part III (see Appendix B).

Definitions of Variables

For the purpose of evaluating the programmatic effects, data were collected on 13 variables: one independent variable, four dependent variables, one classification variable, three covariates, and four extraneous variables. The independent variable was class size. The four dependent variables were posttest reading achievement, posttest mathematics achievement, posttest language achievement, and posttest overall achievement. The classification variable was school district. The three covariates were pretest reading achievement, pretest mathematics achievement, and pretest language achievement. The four extraneous variables examined were student sex, student race, student Title I classification, and student kindergarten experience.

Independent Variable

The independent or manipulated variable in the study was class size. Class size referred to the number of students for which each project teacher was daily responsible. This variable had two levels: (1) the small (experimental) class size of 21 students and (2) the large (control) class size of 29 students. The assignment of the students to either the small class or the large class is discussed in the section of this chapter entitled, "Student Assignment to Treatment Groups".

Dependent Variables

The two primary dependent variables that were used to observe the effects of the independent variable in this study were posttest reading achievement and posttest mathematics achievement. Two other dependent variables that were also investigated were posttest language achievement and posttest overall achievement. The Comprehensive Tests of Basic Skills, Form S (CTBS/S), Level B, which was administered in May of 1977 was used to measure these four variables. In order to insure consistency in test administration procedures across the project classes, the project teachers followed the administration procedures specified in the CTBS/S Examiner's Manual, Level B. Additional instructions about the posttest administration were mailed to the project teachers (see Appendix C for these additional instructions).

The posttest reading achievement of each student was defined as the class mean scale score on the Reading Test of the CTBS/S, Level B. The Reading Test consisted of the following subtests: Letter Sounds, Word Recognition I, Word Recognition II, and Reading Comprehension.

The posttest mathematics achievement was defined as the class mean scale score on the Mathematics Test of the CTBS/S, Level B. The Mathematics Test consisted of the following two subtests: Mathematics Concepts and Applications and Mathematics Computation.

The posttest language achievement was defined as the class mean scale score on the Language Test of the CTBS/S, Level B. The Language Test consisted of the following two subtests: Language I and Language II.

The posttest overall achievement was defined as the class mean scale score derived from a composite of the Reading Test, Mathematics Test, and Language Test of the CTBS/S, Level B (Battery Total score). In computing the Battery Total score, all of the items on the Reading, Mathematics, and Language Tests are pooled; and a score is generated from this new set of items. Additionally, only the scores of students who completed all parts of the Reading, Mathematics, and Language Tests are included in the Battery Total score.

Classification Variable

Only one classification variable, school district unit, was used in the analysis of the project data. A school district unit referred to one pair of project classes, an experimental class and a control class.

Covariates

The three covariates, pretest reading achievement, pretest mathematics achievement, and pretest language achievement, were used to adjust for initial differences in student achievement for both the experimental and control classes. The CTBS/S, Level A, was administered in September of 1976 as a measure of prior student achievement. The project teachers followed the administration procedures specified in the CTBS/S Examiner's Manual, Level A, to insure consistency in test administration procedures across the project classes. Additional instructions specific to the project were also provided to the teachers (see Appendix D for these additional instructions). These administration procedures were explained in detail to the project teachers at

the Pretest Workshops to further ensure consistency.

The pretest reading achievement was defined as the class mean scale score on the Reading Test of the CTBS/S, Level A. The Reading Test consisted of the following subtests: Letter Forms, Letter Names, Listening for Information, Letter Sounds, Visual Discrimination, Sound Matching, and Language.

The pretest mathematics achievement of each student was defined as the class mean scale score on the Mathematics Test of the CTBS/S, Level A. The Mathematics Test was not divided into subtests.

The pretest language achievement of each student was defined as the class mean scale score on the Language Test of the CTBS/S, Level A. The Language Test is a subscale of the Reading Test.

Extraneous Variables

Data were collected for the investigation of four variables which could have had confounding effects on student achievement. These variables were: student sex, student race, student Title I classification, and student kindergarten experience. These data were coded by the project teachers in the Special Codes Section of the student posttest booklets (CTBS/S, Level B).

The variable student sex had two levels: male and female.

The variable student race had two levels: white and nonwhite

The variable student Title I classification referred to whether or not a student was classified as Title I under the 1965 Elementary and Secondary Education Act (ESEA) of Public Law 89-10 as ammended. Students were classified into one of four categories: (1) as not being in

a Title I reading and/or mathematics program, (2) as being in both a Title I reading and mathematics program, (3) as being in only a Title I reading program, and (4) as being in only a Title I mathematics program. For data analysis purposes, Category 2, Category 3, and Category 4 were collapsed into one category, with the result being only two categories for Title I classification: (1) those students who were not in a Title I reading and/or mathematics program and (2) those students who were in a Title I reading and/or mathematics program.

The variable student kindergarten experience referred to whether a student was classified either as having kindergarten experience or as not having kindergarten experience. A student was regarded as having kindergarten experience if he or she had participated in a planned educational program, whether public or private, below the first grade level. Day care centers, nursery schools, Head Start Programs, and short-term programs were not included as kindergarten experience.

Research Design of the Project

A completely randomized block research design with mixed effects was used to investigate the effects of class size on the achievement of first grade students. The blocks (random factor) were the school district units which consisted of a pair of classes, an experimental class and a control class. The fixed factor was the independent variable class size which had two levels, class size of 21 and class size of 29. Within each school district unit, first grade students were randomly selected and assigned to the experimental (small) class of 21 students or the control

(large) class of 29 students. Two teachers within each school district unit were then randomly selected and assigned to one of the two project classes. Districts were required to document any deviations in the procedures and provide this documentation to the Office of Research.

Of crucial importance was maintaining the class sizes of 21 and 29 for the entire School Year 1976-77. A requirement for district participation was that the district be able to formulate classes with these exact sizes at the beginning of the school year (see Table 1). During the school year, procedures were specified for the replacement of students who transferred out of the project classes.

The four dependent variables were posttest reading achievement, posttest mathematics achievement, posttest language achievement, and posttest overall achievement as measured by the CTBS/S, Level B, at the end of the School Year 1976-77. The CTBS/S, Level A, which was administered at the beginning of the school year, was used to measure the prior achievement of the project first graders. The covariates, pretest reading achievement, pretest mathematics achievement, and pretest language achievement were used to adjust for initial differences in first grade student achievement that might have existed between the experimental and control classes. For both the pretest and posttest administrations, the project teachers followed standardized testing procedures to ensure consistency in testing practices across the project classes.

Data were collected on student sex, student race, student Title I classification, and student kindergarten experience for the purpose of investigating possible confounding effects that these variables might

have had on the dependent variables. The results of the chi square tests for independence are presented in Chapter III.

Two features were incorporated into the design to attempt to control for extraneous variables that could possibly confound the project results. These control features were implemented in the areas of paraprofessional assistance and reading and mathematics instruction.

No project class was allowed the use of paraprofessional assistance in the instruction of reading or mathematics. Paraprofessional assistance included assistance from such persons as teacher aides and student teachers. In the 1975-76 project, utilization of teacher aides was permitted under the restriction that both the small class and the large class within a given class pair received the same type and amount of assistance. Although this variable was considered to be controlled because each class was matched on this variable, this variable could be more stringently controlled by not permitting utilization of paraprofessional assistance at all. Therefore, in the 1976-77 project, paraprofessional assistance was not permitted in the project classes.

Funds did not permit the workshops and observations that would be necessary to control for instruction in reading and mathematics. Therefore, as an alternative, an attempt was made to control instruction indirectly through the use of project objectives. At the three regional pretest workshops, the teachers formulated reading and mathematics objectives to serve as guides in the instruction of students in the two subject areas (see Appendix E for the Project Reading and Mathematics Objectives). At the three in-service workshops which were held between

the pretest and posttest administrations, the project teachers received instruction on methods of teaching difficult reading and mathematics concepts as specified in the project objectives. The Reading and Mathematics Consultants of the Office of General Education, Curriculum Section, were responsible for this part of the program. Additionally, minimum time limits of 275 minutes in the instruction of reading per week and 225 minutes in the instruction of mathematics were set. These time limits were in accordance with the Defined Minimum Program of the State Department of Education.

Prior to both the administration of the pretest and the administration of the posttest, the first graders were administered practice tests provided by CTB/McGraw-Hill. The purpose of these practice tests was to provide students with experience in taking multiple choice tests. Additionally, the student data coded in the Special Codes Section on the front of the test booklets were edited for accuracy. These data included student sex, student race, student Title I classification, and student kindergarten experience. Miscoded data were corrected.

For purposes of quality control, the student pretest and posttest responses and all other data collected on the test booklets were edited. The student pretest and posttest responses were edited by trained clerks for multiple gridding, extraneous marks, and responses marked too lightly to ensure accuracy in scoring. Booklets containing patterned responses and multiple gridding throughout the tests were not included in the scoring so that these data would be eliminated from the analysis. Editing procedures followed in the data analysis are given in Chapter III.

CHAPTER III

ANALYSIS PROCEDURES AND FINDINGS

Introduction

A three-stage procedure was used in the analysis of the project data: (1) an edit of the data, (2) an examination of extraneous variables, and (3) tests of significant differences among treatment groups. These three stages are discussed in the first three sections of this chapter. The findings based on the tests of significant differences between the two treatment groups, the small class size group and the large class size group, are presented in the second section. (See Appendix F for the definitions of symbols used in the tables of the results.)

Edit of the Data

School districts were first examined to determine if any class pair should be eliminated from the analysis. Criteria for elimination included the extent that the district deviated from the research design and/or the extent that the data were obviously invalid. No school district deviated from the design to such an extent that the test data had to be eliminated. Furthermore, the class test data for each of the school districts appeared to represent measures of achievement in a "normal" situation. Therefore, the data for no entire school district had to be completely eliminated from the analysis. Thus, the data set

for the analysis remained to be 50 observations (50 project classes: 25 experimental classes and 25 control classes).

After the test data were examined on a school district basis, individual students' test scores were reviewed to determine which students' scores had to be eliminated from the data set as a result of being invalid or unmatched. All first grade students whose pretest and posttest responses were considered invalid as a result of multiple gridding or patterned responses were eliminated. This edit was performed by clerks prior to scoring the test booklets (see the Research Design of the Project Section of Chapter II). All first grade students who were missing all three pretest measures (pretest reading achievement, pretest mathematics achievement, and pretest language achievement) or all four posttest measures (posttest reading achievement, posttest mathematics achievement, posttest language achievement, and posttest overall achievement) were also eliminated from the analysis.

As a result of these procedures, one hundred and eighty-five students were eliminated from the analysis data set for a total of 1,109 students with matched test data remaining. Note, however, that not all of these students had complete pretest and posttest scores. The number of students used in testing each hypothesis was contingent upon the achievement measures required. Students with missing achievement scores for the achievement measures considered in the hypothesis were not included in the analysis for that hypothesis. However, these students were included in the analysis of those hypotheses for which these students had the necessary scores. Similarly, students with outlier achievement scores

were not included. Outlier scores were those scores which fell outside the valid upper or lower scale score limits (see Table 2).

Table 2

Valid Scale Score Limits
Used for Editing Achievement Measures

Variable	Valid Scale Score Lower Limit	Valid Scale Score Upper Limit
Pretest Reading Achievement[a]	8	290
Pretest Language Achievement[a]	62	322
Pretest Mathematics Achievement[a]	109	284
Posttest Reading Achievement[b]	29	346
Posttest Language Achievement[b]	44	398
Posttest Mathematics Achievement[b]	111	350
Posttest Overall Achievement[b]	19	370

[a] CTBS, Form S, Level A, administered in September, 1976.

[b] CTBS, Form S, Level B, administered in May, 1977.

Based upon the elimination of missing or outlier achievement scores, the maximum number of students included in the data analysis for a hypothesis was 1,109; and the minimum number of students included in the data analysis for a hypothesis was 907. Table 3 presents the number of students with missing and/or outlier pretest and posttest achievement measures lost per student.

Table 3

Total Frequency of Individual Missing and Outlier Pretest and Posttest Achievement Measures by Treatment

Number of Lost Pretest and Posttest Achievement Measures Per Student[a]	Experimental Group Frequency	Control Group Frequency	Total[b] Percent
1 of 7	66	84	13.53%
2 of 7	12	21	2.98%
3 of 7	5	10	1.35%
4 of 7	1	0	0.09%
5 of 7	2	1	0.27%
6 of 7	0	0	0.00%
7 of 7	0	0	0.00%
TOTAL	86	116	18.21%

[a]Each project class constituted one observation. The frequencies reflect individual students within each class.

[b]$\underline{n}$=1,109 first grade students.

Examination of Extraneous Variables

The second stage of the analysis procedure involved examining extraneous variables to determine if the differences in these extraneous variables among treatment groups were substantial enough to cast doubt on the experimental results. Since variation in achievement as a result of variation in class size was the primary focus of this project, those variables that could have influenced the class mean posttest achievement results were studied. The effects of the following extraneous variables were analyzed by the class size variable through the use of chi-square tests of independence: student sex, student race, student Title I classification, and student kindergarten experience. If any one of these variables were present in one class size category to a greater degree than in the other class size category, the difference observed in student posttest achievement could have been attributable to an imbalance in the extraneous variable rather than to the class size variable.

Table 4 reveals the percent distribution of first grade students in terms of sex and class size category. Both small and large classes were fairly evenly distributed as far as sex was concerned. As a result, the distribution yielded a chi-square value of .02 which was not significant, $p>.05$.

Table 5 reflects the percent distribution of first grade students in terms of race and class size category. Students were categorized as either white or nonwhite. Whites accounted for 53.30% of the small class group and 50.94% of the large class group. The distribution yielded a chi-square value of .61 which was not significant, $p>.05$.

Table 4

Percent Distribution of Sex by Class Size Category

Class Size Category	Sex[a]	
	Males	Females
Small Classes	50.11%	49.89%
Large Classes	49.69%	50.31%
Absolute Difference	0.42%	0.42%

[a] $\chi^2_{(1)} = .02$, $p > .05$.

Table 5

Percent Distribution of Race by Class Size Category

Class Size Category	Race[a]	
	Whites	Nonwhites
Small Classes	53.30%	46.70%
Large Classes	50.94%	49.06%
Absolute Difference	2.36%	2.36%

[a] $\chi^2_{(1)} = .61$, $p > .05$.

Table 6 reflects the percentage of first grade Title I students in small classes and in large classes. In the small classes, 5.49 percent of the students were enrolled in Title I programs; in the large classes, 2.97 percent of the students were enrolled in Title I programs. The percentages for the two treatment groups differed by 2.52%. This table yielded a chi-square value of 4.38 which was significant, $p<.05$. Although not tabled, the greatest difference in any one pair of classes was 45.00%. In this class pair, the small class contained a higher proportion of Title I students than the large class. At the other extreme, the large class contained 3.70% more Title I students than the small class. The comparisons between the small classes and the large classes indicated that the group of small classes contained a significantly greater proportion of Title I students than the group of large classes.

Classes with small proportions of Title I students are generally assumed to have higher achievement levels than classes with large proportions of Title I students. Thus, the group with the smaller proportion of these students would have a slight advantage over the group with the larger proportion of these students. Since the large class size group had a smaller proportion of Title I students than the small class size group, a slight bias favoring the large class size group could exist in the results (see Table 6).

Table 7 reveals the percentages of first grade students in each class size category who had attended kindergarten prior to the first grade. In the small classes, 84.30 percent of the first graders had

Table 6

Percent Distribution of Title I Students by Class Size Category

Class Size Category	Title I Classification[a]	
	Title I	Non-Title I
Small Classes	5.49%	94.51%
Large Classes	2.97%	97.03%
Absolute Difference	2.52%	2.52%

[a] $\chi^2_{(1)} = 4.38$, $p < .01$.

Table 7

Percent Distribution of Students Having Kindergarten Experience by Class Size Category

Class Size Category	Kindergarten Classification	
	Kindergarten	No Kindergarten
Small Classes	84.30%	15.70%
Large Classes	84.88%	15.12%
Absolute Difference	0.58%	0.58%

[a] $\chi^2_{(1)} = .07$, $p > .05$.

kindergarten experience; whereas, in the large classes, 84.88 percent of the first graders had kindergarten experience. The absolute difference between the mean percentages of the two class size categories (0.58%) did not prove to be statistically significant, $p>.05$.

As a final check on equivalence between the two class size categories, pretest measures of achievement were analyzed. The pretest measures were class mean expanded scale scores on the Reading, Mathematics, and Language Subtests of the Comprehensive Tests of Basic Skills, Form S, Level A. Tables 8, 9, and 10 report results of these analyses by the two class size categories. The two class size groups differed only slightly on the pretest measures of reading, mathematics, and language achievement. Neither the difference of 0.33 scale score units for reading, the difference of 0.20 scale score units for language, nor the difference of 2.46 scale score units for mathematics proved to be statistically significant. These findings support the contention that initially the two class size categories were substantially equivalent on the pretest measures of reading, mathematics, and language achievement.

Of particular interest was the finding that the greatest absolute difference between classes in a pair favored the large class for reading and mathematics and favored the small class for language. For these pairs, the difference in reading was 22.16 scale score units; in mathematics, 27.38; and in language, 40.87. Differences favoring the small classes tended to counteract the differences favoring the large classes.

In summary, the two class size groups were substantially equivalent on all extraneous and control variables except student Title I classification. For this variable, a slight bias favoring the large class size

Table 8

Class Scale Score Means (M) for Pretest Reading Achievement by Class Size Category

Class Size Category[a]	Lowest Measure	Highest Measure	M	Range
Small Classes	91.00	283.00	191.92	192.00
Large Classes	73.00	283.00	191.59	210.00
Absolute Difference			0.33	

[a] n=25 pairs of classes.

Table 9

Class Scale Score Means (M) for Pretest Mathematics Achievement by Class Size Category

Class Size Category[a]	Lowest Measure	Highest Measure	M	Range
Small Classes	128.00	271.00	209.26	143.00
Large Classes	128.00	271.00	206.80	143.00
Absolute Difference			2.46	

[a] n=25 pairs of classes.

Table 10

Class Scale Score Means (M) for Pretest Language Achievement by Class Size Category

Class Size Category[a]	Lowest Measure	Highest Measure	M	Range
Small Classes	94.00	287.00	221.47	193.00
Large Classes	104.00	287.00	221.27	183.00
Absolute Difference			0.20	

[a] n=25 pairs of classes.

group existed since the large classes had a smaller percentage of Title I students than the small classes.

Tests of Significant Differences

Since the districts (the schools) were assumed to be randomly selected and the experimental units (the classes) were randomly assigned to the treatments within each district, the experimental design of the study was a completely randomized block.

Two factor analyses of variance and covariance were used to determine if there were significant differences between the two treatment groups. The treatment or independent variable, class size, consisted of two levels (small classes and large classes). The blocks or categorical factor, school districts, consisted of 25 levels. Each of the 25 school districts that were used in the analysis contained two classes, a small class and a large class. The treatments were classified as fixed effects; while, the blocks were classified as random effects. The pretest measures of reading achievement, mathematics achievement, and language achievement were used as covariates. These covariates were used to adjust the posttest measures of reading, mathematics, language, and overall achievement for initial differences in student achievement. Both the pretest and posttest measures of reading, achievement, mathematics achievement, and language achievement, as well as the posttest overall achievement, were class means and not individual student scores. The reason class means were used was that the treatment, class size, was implemented on a class basis rather than an individual student basis.

Since both analysis of variance and analysis of covariance were performed on the data, Fisher's Relative Efficiency formula was used to determine which of the two procedures would be the more efficient. For each of the four dependent variables, the analysis of covariance procedure proved to be more efficient than the analysis of variance procedure.

Findings

In this section, the findings based on the tests of significant differences between the two treatment groups, the small class size group and the large class size group, are presented by hypothesis. The four hypotheses were tested using pretest reading achievement, pretest mathematics achievement, and pretest language achievement as the covariates.

Hypothesis I: There will be no significant difference in the reading achievement of first grade students in small classes and the reading achievement of first grade students in large classes.

Hypothesis I was tested by using pretest reading achievement as the covariate and posttest reading achievement as the dependent variable.

The adjusted means for the posttest reading achievement scores of the two class size groups are presented in Table 11.

The results from the analysis of covariance indicated that the mean posttest reading achievement for the small class size group was not significantly higher than the mean posttest reading achievement for the large class size group, $F_{(1,23)}=1.95$, $p>.05$. These results are summarized in Table 12.

Table 11

Adjusted Class Scale Score Means (M) for Posttest Reading Achievement by Class Size Category

Class Size[a]	M
Small Classes	266.54
Large Classes	262.39

[a] n=25 pairs of classes.

Table 12

Analysis of Covariance Summary Table for the Class Mean Posttest Reading Achievement Scale Scores

Source	df[a]	SS[b]	MS	F
Class Size	1	265.55	265.55	1.95
District	24	12789.23	532.89	
Class Size x District	23	3139.99	136.52	

[a] The covariate pretest reading accounted for 1 df and substantially reduced the error variance in the dependent variable.

[b] Sums of squares are partitioned sequentially in the order indicated in the table.

*p<.05.

Hypothesis II: There will be no significant difference in the mathematics achievement of first grade students in small classes and and the mathematics achievement of first grade students in large classes.

This hypothesis was tested using pretest mathematics achievement as the covariate and posttest mathematics achievement as the dependent variable.

The adjusted means for the posttest mathematics achievement of scores for the two class size groups are presented in Table 13.

Table 13

Adjusted Class Scale Score Means (M) for Posttest Mathematics Achievement by Class Size Category

Class Size	M
Small Classes	270.35
Large Classes	264.99

[a] n=25 pairs of classes.

The results from the analysis of covariance indicated that the mean posttest mathematics achievement for the students in small classes was not significantly different from the mathematics achievement of those students in large classes, $F_{(1,23)}=2.63$, $p>.05$. These results are summarized in Table 14.

Table 14

Analysis of Covariance Summary Table for the
Class Mean Posttest Mathematics Achievement Scale Scores

Source	df[a]	SS[b]	MS	F
Class Size	1	255.70	255.70	2.63
District	24	4983.20	207.63	
Class Size x District	23	2234.51	97.15	

[a]The covariate pretest mathematics achievement accounted for 1 df and substantially reduced the error variance in the dependent variable.

[b]Sums of squares are partitioned sequentially in the order indicated in the table.

*$p<.05$.

Hypothesis III: There will be no significant difference in the language achievement of first grade students in small classes and the language achievement of first grade students in large classes.

Hypothesis III was tested by using pretest language achievement as the covariate and posttest language achievement as the dependent variable.

Table 15 reveals the adjusted means for the posttest language achievement scores of the two class size groups.

Table 15

Adjusted Class Scale Score Means (M) for Posttest Language Achievement by Class Size Category

Class Size[a]	M
Small Classes	276.68
Large Classes	275.50

[a] n=25 pairs of classes.

The results of the analysis of covariance are presented in Table 17. The analysis of covariance indicated that class size did not significantly affect the posttest language achievement of first graders, $F_{(1,23)}=.05$, $p>.05$.

Table 16

Analysis of Covariance Summary Table for the Class Mean Posttest Language Achievement Scale Scores

Source	df[a]	SS[b]	MS	F
Class Size	1	14.77	14.77	0.05
District	24	10560.88	440.04	
Class Size x District	23	6269.95	272.61	

[a] The covariate pretest language achievement accounted for 1 df and substantially reduced the error variance in the dependent variable.

[b] Sums of squares are partitioned sequentially in the order indicated in the table.

*$p<.05$.

Hypothesis IV: There will be no significant difference in the overall achievement of first grade students in small classes and the overall achievement of first grade students in large classes.

An analysis of covariance was also performed using pretest reading achievement, pretest mathematics achievement, and pretest language achievement as covariates and posttest overall achievement as the dependent variable. Posttest overall achievement was defined as the class mean posttest Battery Total scale score on the CTBS/S, Level B. The Battery Total score is a composite measure of reading, mathematics, and language achievement.

The adjusted posttest overall achievement scale score means are given in Table 17.

Table 17

Adjusted Class Scale Score Means (M) for Posttest Overall Achievement by Class Size Category

Class Size[a]	M
Small Classes	225.59
Large Classes	216.82

[a] n=25 pairs of classes.

In Table 18, the results from the analysis of covariance indicated that the mean posttest overall achievement for the small class size group was not significantly different from the mean for the large class size group, $F_{(1,23)}=1.10$, $p>.05$.

Table 18

Analysis of Covariance Summary Table for the Class Mean Posttest Overall Achievement Scale Scores

Source	df[a]	SS[b]	MS	F
Class Size	1	212.98	212.98	1.10
District	24	11535.72	480.66	
Class Size x District	23	3886.34	194.32	

[a]The covariate pretest reading achievement accounted for 1 df and substantially reduced the error variance in the dependent variable.

[b]Sums of squares are partitioned sequentially in the order indicated in the table.

*$p<.05$.

CHAPTER IV

SUMMARY OF THE RESULTS, DISCUSSION, AND RECOMMENDATIONS

Introduction

In the first section of this chapter, the results for each of the four hypotheses are summarized. The second section contains discussions of the results and recommendations for future investigations with respect to the effects of class size on student achievement.

Summary of the Results

A summary of the results with respect to each of the four hypotheses is presented in this section.

Hypothesis I Results

The reading achievement of first grade students in small classes was not significantly different from the reading achievement of first grade students in large classes. Although the average or mean reading achievement of the first graders in small classes (266.54) was slightly higher than the average or mean reading achievement of the first graders in large classes (262.39), the difference was not sufficient to be considered a "real" difference in reading achievement.

Hypothesis II Results

The average or mean mathematics achievement of first graders in small classes (270.35) was not significantly higher than the average

or mean mathematics achievement of first graders in large classes (264.99). The results indicated that reducing class size did not have an effect on the mathematics achievement of first grade students.

Hypothesis III Results

The average language achievement of first grade students in small classes (276.68) was not significantly different from the average language achievement of first grade students in large classes (275.50). The language achievement difference between small and large classes was insufficient to be considered a "true" difference.

Hypothesis IV Results

The average overall achievement of first grade students in small classes (225.59) was not significanlty higher than the average overall achievement of first grade students in large classes (216.82). The difference in average scores for the two class size groups on posttest overall achievement was larger than those differences that the two groups exhibited on the other three posttest measures. However, this difference in overall achievement was not substantial enough to be considered a "real" difference. Thus, the difference between the two class size groups was considered to be a "chance" difference rather than a "real" difference.

Discussion and Recommendations

The results obtained for each of the four hypotheses support the findings of previous research which indicate that class size does not

affect student achievement (Taylor and Fleming, 1972).

The results indicate that "statistically" there was no difference in achievement between the small and large class size groups. However, for each subject area examined, as well as for the overall achievement, the small class size group average was higher than the large class size group average.

The results obtained for the School Year 1976-77 appear to contradict some of the findings of the study conducted during the School Year 1975-76. In the 1975-76 study, class size had a significant effect on reading and overall achievement. There are three feasible reasons for the inconsistency in the findings for the two years.

First, the contradictions in several of the results could be attributable to the imbalance of Title I students in the two class size groups. Since the large class size group had a smaller proportion of Title I students than the small class size group, a slight bias favoring the large class size group might have existed.

Second, nationally standardized measures were used to assess the pretest and posttest achievement levels of the students. Tests that are constructed and standardized for students in other regions of the country may not be measuring objectives relevant to a South Carolina study. Thus, a test that is constructed and standardized for South Carolina first grade students would be more appropriate.

Third, there were major changes in the design of the project for the second year. During the first year of the project, paraprofessional assistance was permitted; and teacher in-service varied on a school-by-

school basis. However, during the second year of the project, paraprofessional assistance was not permitted; and all teachers received in-service training. These changes in the project design could possibly account for the inconsistencies found in the findings for the two years.

Future analyses of the 1976-77 project data should include analyses of various subgroups of students. The class size data should be analyzed by sex, race, and ability. The Office of Research plans to conduct these analyses in the future as a supplement to this report.

The contradictions found in the 1975-76 and 1976-77 studies provide evidence of the need for continued research in this area. Several recommendations concerning the project design are provided in the event that this type of study is continued or is conducted elsewhere.

1. Perhaps the most important revision needed concerns the measurement of the dependent variable, outcome achievement. An instrument or test should be designed to measure the outcome variables (whether cognitive or affective in nature) of the study; and, furthermore, this instrument should be piloted on a sample of the target population.
2. The experiment should be carried out for a three-year period on the same group of students rather than for two one-year periods on different groups of students. A longitudinal design would ensure that any exhibited differences are "true" differences and not just differences attributable to the influence of the experiment itself (Balow, 1969; Furno and Collins, 1967).

Additionally, a longitudinal experiment would enable the researcher to determine the long-term effects rather than just the short-term effects that could possibly be a result of an individual's awareness that he is participating in an experiment, the "Hawthorne Effect" (Roethlisberger and Dickson, 1940).

3. The incorporation of three or more class size groups instead of two class size groups would be beneficial. The desired design would require the examination of the effects of "very" small classes", "small classes", "medium classes", "large classes", and "very large classes" on student achievement. The literature indicates that there are perhaps "critical breakpoints" between class size groups where differences in student performance are maximized (Olson, 1971). This design, however, is perhaps impractical because of the funds that would be necessary to conduct such a study.
4. Variables measuring teaching techniques, teacher attitudes, student attitudes, student classroom behavior, classroom environment, and amount of time spent on instruction in the subject areas of interest should be examined. Additionally, indicators of the classroom educational process should be assessed on the basis of individualization, interpersonal regard, group activity, and creativity (Olson, 1971). The measurement of several of these variables would necessitate classroom observations of students and teachers.

5. Subgroups of students based on age, race, sex, ability, and socioeconomic status should be examined to determine if reducing class size results in higher achievement for one subgroup than for other subgroups under experimental conditions.

These recommendations allude to just a few of the many problems that need to be corrected and questions that need to be answered. If a project of this type should continue, an attempt should be made to incorporate these recommendations. If significant effects favoring the small class are found, a careful study of "cost implications" should also follow the analysis.

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APPENDIX A

GUIDELINES FOR THE SELECTION OF SCHOOLS, STUDENTS, AND TEACHERS

First Grade Project to Reduce the Pupil/Teacher Ratio

August, 1976

Each district participating in the 1976-77 First Grade Project to Reduce the Pupil/Teacher Ratio will select one school from the district to participate in the project. Within each school, students and teachers will be randomly selected and assigned to an experimental and a control class. The experimental class in each school should contain 21 students, and the control class should contain 29 students. Classroom teachers in the state are funded on the basis of an average daily attendance (ADA) rate of 26 students to one teacher. Therefore, schools should be able to establish an experimental class containing 21 students and a control class containing 29 students. The remainder of this document pertains to the criteria for selection of project schools, guidelines for the selection and assignment of students, guidelines for the selection and assignment of teachers, and non-utilization of paraprofessional assistance.

Please precisely follow the guidelines specified on the following pages. Consistency across project schools in following these guidelines is crucial to the defensibility of the project results. If you should encounter any problem in following these guidelines, immediately contact Lynne Johnson or Vana Meredith at 758-8611 so that we can assist you in reaching a solution. Please document this solution in detail on the enclosed "School Procedures Documentation Form".

GUIDELINES FOR THE SELECTION OF SCHOOLS, STUDENTS, AND TEACHERS
page two

I. Criteria for Selection of Project Schools

Select the school from your district for the First Grade Project that meets the following criteria:

Criterion 1: At least 50 first grade students are contained in one school building.

Criterion 2: Additional classroom space is available in the school building.

Criterion 3: Total commitment to participate in an evaluation design investigating the effect of reducing class size in the first grade can be guaranteed. This commitment applies to all aspects of the design, including sample selection and assignment, testing, and non-utilization of paraprofessional assistance.

Criterion 4: Local funds are available for: (a) classroom renovation and equipment and (b) local supplement for teachers salary.

II. Guidelines for First Grade Student Selection and Assignment of these Students to Experimental and Control Classes

A. Guidelines for the Selection of Those First Graders Who Will Participate in the Project

1. Prior to the opening of school in your district, have the principal of the selected project school obtain the names of all NON-SPECIAL EDUCATION first graders who have pre-enrolled for the 1976-77 school year. This list should be as complete as possible given the impending opening of school and the time needed for assigning students to classes.

2. Place the name of each of these NON-SPECIAL EDUCATION first graders on a small slip of paper. You should have one slip of paper for each first grader.

3. Place all of the slips of paper containing the names of the first graders in a container (waste basket, hat, etc.).

4. Draw 50 slips of paper from the container. Shake the container before each drawing.

5. You have now randomly selected those students that will particpate in the First Grade Project. Follow the guidelines specified in the next section to randomly assign these 50 students to the experimental and control classes.

GUIDELINES FOR THE SELECTION OF SCHOOLS, STUDENTS, AND TEACHERS
page three

B. Guidelines for the Assignment of First Grade Project Students to Experimental and Control Classes

1. Place the 50 slips of paper containing the names of the 50 first grade students that have been randomly selected to participate in the project in a container (waste basket, hat, etc.).

2. Draw 21 slips of paper from the container. Shake the container before each drawing. These 21 first grade students constitute the experimental class.

3. The 29 names of the students remaining in the container constitute the control class.

4. You have now randomly assigned the 50 students to the experimental and control classes.

C. Guidelines for the Replacement of First Grade Project Students Who Transfer Out of the Project School

1. If students who were selected to be in project classes prior to the beginning of school are not present on the first or second day of class, randomly select and assign replacement students from those NON-SPECIAL EDUCATION first grade students who did not pre-enroll. Use the procedures outlined in Sections II-A and II-B for this student replacement process.

2. If students in the project classes transfer out of the project school at some other time during the school year, replace these students with the new NON-SPECIAL EDUCATION first grade students who enroll during the year. If you should have vacancies in both the experimental and control classes, replace the students in the order in which the vacancies occurred in the classes. AT NO TIME SHOULD THE INITIAL CLASS SIZES OF THE EXPERIMENTAL AND CONTROL CLASSES BE EXCEEDED.

III. Guidelines for the Selection of First Grade Project Teachers and Assignment of These Teachers to the Experimental and Control Classes

A. Guidelines for the Selection of Those First Grade Teachers Who Will Participate in the Project

1. Prior to the opening of school in your district, have the principal of the project school obtain the names of all first grade teachers in that school. This list should be as complete as possible and should only contain the names of those first grade teachers that are committed for a full year.

2. Place the name of each of these teachers on a small slip paper. You should have one slip of paper for each of the first grade teachers in the selected school.

3. Place all of the slips of paper containing the names of the teachers in a container (waste basket, hat, etc.).

4. Draw 2 slips of paper from the container. Shake the container before each drawing.

5. You have now randomly selected the names of the two teachers who will participate in the First Grade Project. Follow the guidelines specified in the next section to randomly assign these two teachers to the experimental and control classes.

B. Guidelines for the Assignment of First Grade Project Teachers to Experimental and Control Classes

1. Place the 2 slips of paper containing the names of the 2 first grade teachers that have been randomly selected to participate in the project into a container (waste basket, hat, etc.).

2. Shake the container and draw one slip of paper from the container. This teacher will be the teacher of the EXPERIMENTAL CLASS.

3. The name of the teacher on the slip of paper remaining in the container will be the teacher of the CONTROL CLASS.

4. You have now randomly assigned the 2 teachers to the experimental and control classes. Do not deviate from this assignment procedure. Remember the FIRST teacher selected is assigned to the EXPERIMENTAL CLASS, and the SECOND teacher is assigned to the CONTROL CLASS.

GUIDELINES FOR THE SELECTION OF SCHOOLS, STUDENTS, AND TEACHERS
page five

IV. Non-Utilization of Paraprofessional Assistance

The evaluation design for the project necessitates control of the use of paraprofessional assistance, such as teacher aides or student teachers. This year NO project classes are to have paraprofessional assistance unless this criterion conflicts with the Title I Comparability Requirement. Districts that might be involved with this conflict should be aware of this problem. If your district has this problem, contact Lynne Johnson or Vana Meredith at 758-8611 to receive instructions about the utilization of paraprofessional assistance.

SCHOOL PROCEDURES DOCUMENTATION FORM

FIRST GRADE PROJECT TO REDUCE THE TEACHER/PUPIL RATIO

AUGUST, 1976

Name of Respondent: _____
Position: _____
District: _____
Date: _____

Return by August 25, 1976, to:
Educational Assessment Section
State Department of Education
Room 604, Rutledge Building
Columbia, South Carolina 29201

Instructions: Please refer to the enclosed "Guidelines for Selection of Schools, Students, and Teachers" in completing this form. Each participating district is required to fill out this form.

PART I: Problems Relating to Criteria for Selection of Project Schools

Directions: If you had any problem(s) in meeting the criteria for school selection specified in Section I of the procedures document, please specify the problem(s) in the spaces provided below.

Problem(s)

Criterion 1: _____

Criterion 2: _____

Criterion 3: _____

Criterion 4: _____

PART II: Procedure Documentation for the Selection of First Grade Project Students and Assignment of these Students to Experimental and Control Classes

Directions: In the left hand column of the table below are listed the numbers of the guidelines listed in Sections II-A and II-B of the "Guidelines". In the space to the right of each number, specify in detail the procedures that you used to select and assign students if your procedure in any way deviated from the guidelines for selection and assignment of students. Write "Same" next to those procedures that you did follow precisely. If you need additional space, please attach sheets.

II-A Guidelines for Student Selection	Procedures Used by School in Student Selection
1.	
2.	
3.	
4.	
II-B Guidelines for Student Assignment	**Procedures Used by School in Student Assignment**
1.	
2.	
3.	

PART III: Procedure Documentation for the Selection of First Grade Project Teachers and Assignment of these Teachers to Experimental and Control Classes

Directions: In the left hand column of the table below are listed the numbers of the procedures listed in Sections III-A and III-b of the "Guidelines". In the space to the right of each number, specify in detail the procedures that you used to select and assign teachers if your procedure in any way deviated from the guidelines for selection and assignment of teachers. Write "Same" next to those procedures that you did follow precisely. If you need additional space, please attach sheets.

III-A Guidelines for Teacher Selection	Procedures Used by School in Teacher Selection
1.	
2.	
3.	
4.	
III-B Guidelines for Teacher Assignment	**Procedures Used by School in Teacher Assignment**
1.	
2.	
3.	

PART IV: Paraprofessional Assistance

Directions: Please answer the following question:

Does this district have a conflict with the non-utilization of paraprofessional assistance and the Title I Comparability Requirement? Check the appropriate answer.

_____No, this district does not have a conflict. Paraprofessional assistance will not be utilized in project classes.

_____Yes, this district has a conflict. The conflict has been resolved. The procedure being used to resolve the conflict is: _____

_____

_____

_____

_____

_____Another problem exists. Please specify. _____

_____

_____

_____

_____

PART V: District Project Coordinator

Directions: Appoint a person in the selected school or your district office as the district project coordinator. This person will be primarily responsible for coordinating the testing for the project schools and helping with disseminating project materials to participating teachers. Please provide the information requested below:

District Project Coordinator: _____
Name Position

_____
School District

_____
Street or Box Number City Zip

PART VI: Experimental and Control Class Documentation

Directions: In the spaces provided, please give the complete names of the first graders in the experimental and control classes at the time of the pretesting and the names of the teachers assigned to these classes. We request that you detach this page of the form and return this page completed by September 30, 1976, to:

The Educational Assessment Section
State Department of Education
Room 604, Rutledge Building
Columbia, South Carolina 29201

Experimental Class

Teacher: _____

School: _____

District: _____

Names of Students

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SDE 33-073-00
(This form becomes obsolete 6/30/78)

PART VI: continued

Control Class

Teacher: _____

School: _____

District: _____

Names of Students

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

SDE 33-073-00
(This form becomes obsolete 6/30/78)

PART VII: Student Replacement Documentation

Directions: In the spaces provided please give the names of those students who were initially selected to be in the project classes and who had to be replaced prior to September 15, 1976. Also give the names of the new students who were used as the replacements. Please detach this sheet and mail with PART VI of this form by September 30, 1976, to:

Educational Assessment Section
State Department of Education
Room 604, Rutledge Building
Columbia, South Carolina 29201

Student Initially Selected		Student Replacements
_____	was replaced by	_____
_____	was replaced by	_____
_____	was replaced by	_____
_____	was replaced by	_____
_____	was replaced by	_____
_____	was replaced by	_____

APPENDIX C

Posttest Administration Information and Forms

SCHEDULE FOR POSTTEST ADMINISTRATION
FIRST GRADE PROJECT 1976-77

Date	Activity
April 11 - 20	Project Coordinators receive posttest materials.
April 20 - May 2	Project teachers prepare for posttest administration.
May 2	Project teachers administer Practice Test 2 to their classes.
May 3 - 5	Project teachers administer Comprehensive Tests Of Basic Skills, Form S, Level B to their classes using the following schedule.
	May 3 — Test 1 - Letter Sounds Test 2 - Word Recognition I Break Test 3 - Reading Comprehension
	May 4 — Test 4 - Word Recognition II Test 5 - Language I Break Test 6 - Language II
	May 5 — Test 7 - Mathematics Concepts and Applications Break Test 8 - Mathematics Computation
May 6, 9 - 12	Project teachers conduct make-up test sessions, edit test booklets, and complete coding and necessary forms.
May 12	Project coordinators pick up posttest materials from project teachers.
May 12 - 18	Project coordinators insure that necessary coding and forms are completed and ship materials to State Department of Education.
May 27	Office of Research ships materials to Monterey, California, for scoring.
June 24	Office of Research mails score reports to project coordinators and teachers.

PROJECT COORDINATOR'S POSTTEST ADMINISTRATION CHECKLIST
FIRST GRADE PROJECT 1976-77

Dates	Activity
April 20 - May 2	Preparation for Posttest Administration
April 20 - 22	_____ Distribute the Posttest Administration Teacher's Packet and the posttest materials mailed to you earlier to each project teacher. Delivery of materials at this time should allow teachers plenty of time to prepare for the administration.
	_____ Coordinate the coding of the student identification information and special codes on the test booklet covers (see Instructions for Completion of Student Identification Information and Special Codes). You may be able to provide the teachers with clerical assistance.
	_____ Help the teachers plan and schedule the testing within their schools. The test should be administered using the following schedule:
	May 3 — Test 1 - Letter Sounds Test 2 - Word Recognition I Break Test 3 - Reading Comprehension
	May 4 — Test 4 - Word Recognition II Test 5 - Language I Break Test 6 - Language II
	May 5 — Test 7 - Mathematics Concepts and Applications Break Test 8 - Mathematics Computation.
May 3 - 5	Posttest Administration

POSTTEST ADMINISTRATION PROCEDURES
FIRST GRADE PROJECT 1976-77

Dates	Activity
April 20 - May 2	Preparation for Posttest Administration
	_____ Check the package of posttest materials in the paper band to insure that you have the following:
	1. One (1) CTBS/S, Level B Examiner's Manual;
	2. One (1) Spirit Master for Practice Test 2 with administration instructions; and
	3. One (1) CTBS/S, Level B test booklet for each student in your class.
	In the event that you need additional materials, contact your District Project Coordinator immediately.
	_____ Read your Examiner's Manual carefully to thoroughly familiarize yourself with the test and administration procedures. Part 1 of the manual gives very general information about the test. Parts 2 and 3 contain extremely important and valuable information about the actual test administration. Read these two sections completely prior to the actual administration. We strongly recommend administering the test to a friend for practice.
	_____ Complete the necessary student identification information and special codes information using "Instructions for Completion of Student Identification Information and Special Codes."
May 2	_____ Administer Practice Test 2 following the administration instructions. Be sure to answer any questions that your students may have. Your students need to understand how to darken circles staying within the lines.
May 3 - 5	Posttest Administration
	_____ Administer the posttest following the testing schedule provided in the Schedule for Posttest Administration. Follow the administering instructions given in Part 2 and Part 3 of your Examiner's Manual. Give a paper marker to each student and hold up a test booklet during the administration so that your students can see exactly on which page they should be. Remember, do not use proctors during the test administration.
	_____ Make mental notes of anything that might adversely affect your class's or an individual student's performance on the test. You will need to document this information on the Posttest Administration Documentation Form.

Dates	Activity
	_____ After each day of testing, collect each student's booklet and make sure that you have one booklet for each student.
May 6, May 9 - 12	Make-up Posttest Administration
	_____ Conduct make-up sessions for students who missed parts of the posttest administration. We are particularly interested in those students who took the pretest. Give first priority to those students who only missed a few of the tests. Then, if you have time, administer the test to those students who missed the entire test.
May 6, May 9 - 12	Activities to be Completed after the Posttest Administration
	_____ Check your student's booklets for stray marks. Please thoroughly erase any stray marks such as pictures in the margins, light lines on the page, etc.. A thorough editing job will reduce the chance of incorrect scoring by the optical scanners.
	_____ Check the covers of the student's booklets to make sure that all information has been completed.
	_____ Complete the Posttest Administration Documentation Form.
	_____ Complete the Teacher's Questionnaire and Rating Scale.
May 12	Preparation for Shipping
	_____ Place the following materials in a stack.
	1. Posttest Administration Documentation Form
	2. Pretest Administration Documentation Form
	3. Teacher's Questionnaire and Rating Scale
	4. CTBS/S student test booklets - one for each student who took any part of the test
	5. Teacher-developed Practice Reading and Mathematics Evaluations that were administered in early April
	_____ Complete the yellow Posttest Identification Label.
	_____ Secure the paper band with the attached yellow label. around your stack of materials.
	_____ Contact your District Project Coordinator to arrange for shipment of the materials.

Dates	Activity
May 12 - 18	Preparation for Shipping
May 12	_____ Pick-up the posttest materials from the project teachers. These materials include: 1. Posttest Administration Documentation Form, 2. Pretest Administration Documentation Form, 3. Teacher's Questionnaire and Rating Scale, 4. CTBS/S student test booklets, and 5. Teacher-developed Practice Reading and Mathematics Evaluations that were administered in early April.
	_____ Insure that all student identification information and special codes have been properly coded on the test booklet covers.
	_____ Insure that each teacher has responded to ALL items on the Teacher Questionnaire and Rating Scale.
	_____ Verify that stray marks, such as pictures in margins and light lines, have been erased from the student booklets.
	_____ Insure that the yellow Posttest Identification Label is completely filled out and securely attached to each teacher's group of materials.
	_____ Package the posttest materials using sturdy boxes and packing material (for example, newspaper) to hold posttest materials firm and immobile for transit.
May 18	_____ Ship materials to: Educational Assessment Section State Department of Education Room 604, Rutledge Building Columbia, S. C. 29201

POSTTEST ADMINISTRATION DOCUMENTATION FORM
FIRST GRADE PROJECT 1976-77

Return with posttest materials to:
Educational Assessment Section
State Department of Education
Room 604, Rutledge Building
Columbia, South Carolina 29201

Teacher's Name _____

School's Name _____

District's Name _____

Testing Dates _____

Directions:

This form should be completed and returned to your district project coordinator with the posttest booklets by May 12, 1977. Confidentiality of all student information will be maintained.

Under the column labeled "Name of Student" list the names of all students currently enrolled in your class.

Under the column labeled "Rank", please rank your students according to their intellectual ability as follows: 1 for the student of highest ability, 2 for the next highest, 3 for the next highest, and so on. If you have 21 students in your class, you should use numbers 1 to 21. The number 1 is placed next to the student of highest ability and 21 is placed next to the student of lowest ability. We are trying to obtain some indication of student ability and feel that you are the best judge of this characteristic. Your judgment of each student's rank should be based purely on your own evaluation of the student. You may rely on the student's overall classroom performance, but do not use any single indicator of performance such as standardized test scores or a graded classroom exercise. We realize that you will have two or more students of approximately the same ability. Do not worry about these fine discriminations. Do the best job you can.

Under the column labeled "Participation", circle the word "All" if the student completed all eight tests of the posttest; circle the word "None" if the student did not complete any of the eight tests; circle the word "Some" if the student did not complete all eight tests.

Under the column labeled "Reason for Non-Participation", please give the reason that the student did not participate; for example, sick, not capable, etc..

If you encounter any problems during the posttest administration that might adversely affect your students' performances on the test, briefly describe these problems on the back of this sheet.

Rank	Name of Student	Participation	Reason for Non-Participation
____	_____	All None Some	_____
____	_____	All None Some	_____
____	_____	All None Some	_____

APPENDIX D

Pretest Administration Information and Forms

TIME SCHEDULE FOR PRETEST ADMINISTRATION
FIRST GRADE PROJECT 1976-1977

Dates	Activity
Sept. 8, 9, 14	Project teachers and District Project Coordinators attend regional pretest workshops.
Sept. 8 - 16	Project teachers familiarize themselves with the administration procedures for CTBS, Level A, outlined in the Examiner's Manual; code student information on Student Data Grid and in Special Codes Section; and begin filling out documentation form.
Sept. 16 or 17	Project teachers administer Practice Test I to first grade students.
Sept. 20	Project teachers provide additional practice in taking a standardized test to those students who had difficulty taking Practice Test I.
Sept. 21	Project teachers administer the following subtests of CTBS, Level A:

Session	Test	Total Time
First morning	Test 1 Letter Forms	16
	Break	15
	Test 2 Letter Names	20
First afternoon	Test 3 Listening for Information	25

Sept. 22 — Project teachers administer the following subtests of CTBS, Level A:

Session	Test	Total Time
Second morning	Test 4 Letter Sounds	23
	Test 5 Visual Discrimination	15
Second afternoon	Test 6 Sound Matching	26

Time Schedule for Pretest Administration
page two

Sept. 23	Project teachers administer the following subtests of CTBS, Level A:		
	Session	Test	Total Time
	Third morning	Test 7 Language	25
	Third afternoon	Test 8 Mathematics	36
Sept. 23 and 24	Project teachers complete the "Pretest Administration Documentation Form" and edit test booklets.		
Sept. 24	Project coordinators obtain test booklets from project teachers.		
Sept. 27	Project coordinators ship CTBS, Level A, test booklets and two "Pretest Administration Documentation Forms" (one from each teacher) to the State Department of Education.		
Oct. 1	All pretesting materials have been received by the State Department of Education.		
Oct. 8	All test booklets have been shipped to CTB/McGraw-Hill in Monterey, California, for scoring.		
Nov. 12	Score reports for each project class are mailed to the District Project Coordinators.		

DISTRICT PROJECT COORDINATOR

PRETEST ADMINISTRATION PROCEDURES

FIRST GRADE PROJECT 1976-77

As the District Project Coordinator, your primary responsibilities during the pretest administration are to insure that the dates on the "Time Schedule for Pretest Administration" are met; to resolve any problems (sick project teacher, lack of materials, etc.) that should arise prior to, during, or after the administration and to ship the completed test booklets to the State Department of Education.

I. Procedures to be followed prior to the administration of the pretest are:

1. Make sure that your project teachers have an adequate supply of materials for the pretest.

2. Help project teachers make arrangements for the pretesting in the project school on the required testing dates of September 21, 22, and 23, 1976.

3. The project teachers have many tasks to complete in preparation for the pretesting. You may be able to help the teachers complete certain of these tasks, such as coding the student information on the booklet cover and filling out the "Pretest Administration Documentation Form".

4. Check with your project teachers to see if they have any questions or problems. If there are any questions or problems which you are unable to handle, please contact Lynne Johnson or Vana Meredith at 758-8611.

II. Procedures to be followed after the administration of the pretest are:

1. Anything that you can do to facilitate the editing of the pretest booklets and completion of the "Pretest Administration Documentation Form" will be greatly appreciated by the project teachers.

2. Collect all CTBS, Level A, test booklets (used and unused) and Examiner's Manuals from the project teachers on September 24, 1976. You should collect these materials no later than 12:00 p.m. on September 27, 1976. The September 27, 1976, shipping date is critical in terms of meeting the scoring schedule.

3. Please spot check student booklets for each of your project classes to make sure that extraneous marks (described in "Editing Procedures for Pretest Booklets") have been erased.

4. Make sure the "Class Identification Label" is completely filled out and the brown paper band is taped securely around all testing materials.

5. Pack testing materials in a cardboard box. Use the address label in your packet for the shipping label. Mail the test booklets FIRST CLASS on September 27, 1976, to: Educational Assessment Section, State Department of Education, Room 604, Rutledge Building, Columbia, South Carolina 29201. We request that you mail the booklets FIRST CLASS since we are pressed for time. Any delay in shipping will delay the delivery of score reports to ALL districts participating in the First Grade Project. The total cost of mailing the test booklets FIRST CLASS should be $4.03 for both classes.

III. Activities to anticipate are:

1. There will be three in-service workshops for all project teachers. The first of these has been set for November 8, 1976. We shall contact you and the project teachers by letter to confirm the three in-service dates and give you specific details. If you have any questions regarding in-service workshops, please contact Tom Parks at 758-2652.

2. The possibility that one or two project students will transfer out of the project school during the school year is very likely. Please replace these students as new students transfer into the project school during the school year. (THE CLASS SIZES OF 21 AND 29 ARE NEVER TO BE EXCEEDED.)

3. A posttest will be administered to the project students during April or early May. You will be notified of these dates in October or November so that you can put them on your spring calendar. If you foresee any conflicts, please contact Vana Meredith or Lynne Johnson immediately. At this time, we do not have plans to conduct a posttest workshop. The posttest administration for each project class will be coordinated through the District Project Coordinator.

The Office of Research and Office of General Education would like to thank you for your support and continuing interest in this project.

PRETEST ADMINISTRATION PROCEDURES

FIRST GRADE PROJECT 1976-1977

PRETEST WORKSHOP

I. The procedures to be followed prior to administration of the pretest are:

- ☐ Check your Testing Materials Packet to make sure that your packet contains the following:

  1. A brown paper band with an identification label attached;
  2. Either 23 or 31 test booklets depending on your class size;
  3. One CTBS, Level A, Form S, Examiner's Manual; and
  4. One spirit master for Practice Test I.

- ☐ Read the Examiner's Manual, Parts 1 and 2, Pages 1-10, thoroughly. These parts of the manual will give you a brief description of the test and information on preparing to administer the CTBS, Level A.

- ☐ Thoroughly familiarize yourself with Part 3 of the Examiner's Manual. This part of the manual gives detailed instructions on how to actually administer the CTBS, Level A. We strongly recommend that, in addition to reading through the administration procedures, you administer the test to a friend or member of your family so that you can anticipate any problems that might arise during the administration and determine how to resolve these problems prior to the actual test administration.

- ☐ Code in the student information on the front of each student's test booklet. The instructions for coding the student information are given in the document titled "Pretest Coding Procedures" and on Pages 11-12 of the CTBS Examiner's Manual.

- ☐ Fill out the student name section of the "Pretest Administration Documentation Form." Partial completion of this form prior to the pretest administration will lighten the amount of work to be done after the administration.

- ☐ Duplicate a sufficient number of copies of Practice Test I for the students in your class. Administer Practice Test I on the Thursday or Friday prior to September 21, 22, and 23, 1976. The purpose of the practice test is to give your first grade students experience in taking a standardized test under standardized testing conditions; therefore, carefully follow the instructions for administering Practice Test I. These instructions are given on Pages 12-14 of the Examiner's Manual and are also included with Practice Test I. If some of your students are having difficulties, such as following instructions, darkening bubbles, etc., you should make up an additional practice exercise for these students. This aspect of the pretest administration is crucial as most first graders have not had any experience in taking a standardized multiple-choice test. Test-taking experience can have both positive and negative effects on test results.

PRETEST ADMINISTRATION PROCEDURES
page two

II. The procedures to be followed in administering the CTBS, Level A, test are:

- ☐ Administer the CTBS, Level A, test booklets to your first grade students on September 21, 22, and 23, 1976, explicitly following the instructions and time limits specified in Part 3, Pages 15-47, of the Examiner's Manual. Please follow the testing schedule provided on the "Time Schedule for Pretest Administration."

- ☐ If possible, we are asking that you conduct a make-up test session on Friday, September 24, 1976, for those students who missed one or more of the reading or mathematics subtests. In order to obtain a Total Reading Score, the student must have completed Test 1, Test 2, Test 3, Test 4, Test 5, Test 6, and Test 7. In order to obtain a Total Mathematics Score, the student must have completed Test 8.

III. The procedures to be followed after you have administered the pretest are given below. These procedures need to be followed as soon after the pretest administration as possible (September 23-24, 1976) so that your First Grade Project District Coordinator can mail the booklets to the State Department of Education on the target date, September 27, 1976.

- ☐ Edit each student's test booklet following the procedures outlined in the document entitled "Editing Procedures for Pretest Booklets."

- ☐ Complete the form entitled "Pretest Administration Procedures Documentation Form."

- ☐ Place the test booklets in a neat pile and place the "Pretest Procedures Documentation Form" on top of the student booklets. Fill out the identification label. Then tape the brown paper band with the identification label around your class' test booklets.

- ☐ Deliver your test booklets to your First Grade Project Test Coordinator on September 24, 1976.

PRETEST ADMINISTRATION DOCUMENTATION FORM
FIRST GRADE PROJECT 1976-1977

Teacher's Name: _____
School's Name: _____
District's Name and Number: _____

This form should be returned to your District Project Coordinator with your pretest booklets by September 24, 1976.

Note: Confidentiality of student information will be maintained.

Instructions:

Under the column labeled "Name of Student", place the names of your first graders in alphabetical order by last name in the spaces provided. Write the name of each student exactly as you coded the name on the CTBS, Level A, test booklet cover. The two-digit number in the left-hand column is the Student's Identification Number which you code in Columns E and F of the Special Codes Section of the CTBS, Level A, test booklet cover.

Under the column labeled "Birthdate", give the month and year of birth that you coded on the CTBS, Level A test booklet cover for each student.

Under the column labeled "Participation", check the column labeled "ALL" if the student participated in the administration all three days; "None" if the student missed all three days of the administration; and "Other" if the student participated for less than three days.

Under the column labeled "Reason for Non-Participation", please give the reason the student did not participate.

ID No.	Name of Student Written as Coded on Test Booklet Cover	Birthdate Mo. / Yr.	Participation All None Other	Reason for Non-Participation
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				
24				
25				
26				
27				
28				
29				

Instructions:

If you encountered any problems during the pretest administration that might adversely affect your students' performances, briefly describe these problems on the back of this sheet.

SDE 33-075-00
(This form becomes obsolete 6/30/78)

PRETEST CODING PROCEDURES
FIRST GRADE PROJECT 1976-77

Coding of Student Data Grid

Instructions for coding the information on the Student Data Grid are given in "Part 3: Directions for Administering CTBS" of the Examiner's Manual for Level A, pages 11-12.

There are two points in the manual that need to be emphasized:

1. Be sure to grid in a blank bubble for the space left between the student's first and last names.

2. Begin coding the student's LAST NAME in the leftmost box in the row of boxes. Skip one box and then code in as much of the first name as possible.

Coding of Special Codes Section

In addition to coding the Student Data Grid, you will also code in a Student Identification Number for each of your students in Columns E and F of the Special Codes Section on the front cover of the CTBS, Level A, test booklet.

To obtain the Student Identification Number, alphabetize the names of your first grade students by their LAST names. Then put these names in an alphabetic sequence in the spaces provided under the column labeled "Name of Student" on the "Pretest Administration Documentation Form". Remember to write these names exactly as you have coded them on the front of the CTBS, Level A, test booklet cover.

If you are the teacher of the class containing 21 students, you will only have numbers from 01 to 21. If you are the teacher of the class containing 29 students, you will have numbers from 01 to 29.

Grid the left digit of this identification number in Column E of the Special Codes Section. Grid the right digit of this identification number in Column F of the Special Codes Section. YOU SHOULD HAVE TWO DIGITS CODED FOR EACH STUDENT IN COLUMNS E AND F. PLEASE CHECK EACH STUDENT'S NUMBER TO MAKE SURE THAT YOU HAVE CODED IT CORRECTLY.

EDITING PROCEDURES FOR PRETEST BOOKLETS
FIRST GRADE PROJECT 1976-1977

After you have completed the administration of the pretest, your next task is to edit the pretest booklets. Editing is extremely important in terms of obtaining the most accurate measure of each student's performance on the test. In editing the pretest booklets you need to look for extraneous pencil marks.

Many students in addition to darkening the bubbles will put extraneous marks on the test booklet pages. These extraneous marks need to be thoroughly erased. The most common extraneous marks are lines and drawings. Another common extraneous mark is a light pencil mark in a bubble that was not intended as the correct response. In these instances, there is another bubble for the item that is MUCH darker. Before you erase such a mark, be sure that the item is not a case of multiple gridding. Multiple gridding applies to those items for which the student has darkened more than one bubble. If the student has darkened more than one bubble for an item, DO NOT change the responses in any way.

As a rule of thumb, if there is ANY doubt in your mind as to what the student intended for a particular item, do not change anything for that item.

APPENDIX E

Project Reading and Mathematics Objectives

READING AND MATHEMATICS OBJECTIVES
FIRST GRADE PROJECT 1976-77

The purpose of these objectives is to provide you with guidelines for your reading and mathematics instructional programs and to assist us in planning the in-service workshops. The purpose is not to dictate the minimum or maximum content for reading and mathematics. You are to teach these objectives according to student readiness and understanding.

The reading objectives are subdivided into five major objective categories: Pre-Reading and Readiness Skills, Work Attack, Comprehension, Interpretive Skills, and Study Skills. These five major objectives are sequenced in the order in which they are usually taught; however, the specific objectives within each of these five major objectives are not in any particular sequence. In other words, after the necessary pre-reading and readiness skills are taught, lower work attack skills are taught; then lower level comprehension skills; then lower level interpretive skills; and finally lower level study skills. This cycle then repeats with higher level work attack skills.

The mathematics objectives are subdivided into eight major objective categories: Mathematics Readiness Skills; Numeral Identification, Counting, and Comparison of Numbers; Computation: Addition; Computation: Subtraction; Application; Measurement; Elementary Geometry; and Graph Interpretation. The first five objective categories are sequenced similarly to the reading objectives; that is, these five major objectives are sequenced in the order in which they are usually taught with the specific objectives within each of the categories informally sequenced. In other words after the necessary mathematics readiness skills are taught; lower level numeral identification, counting, and comparison skills are taught; then lower level computation with addition; etc.. The last three categories are usually taught at appropriate points within the first five objective categories.

READING OBJECTIVES
FIRST GRADE PROJECT 1976-77

I. Pre-Reading and Readiness Skills

Personal and social development (R-1)

Oral language: vocabulary concept development (colors, directions words, size, shapes, left/right) (R-2)

Auditory

Auditory discrimination (R-3)

Sound-symbol relationships (R-4)

Listening skills: attention span (R-5)

Visual discrimination: recognition of alphabet (R-6)

Perceptual-Motor (R-7)

Oral reading: appreciation of stories, retelling stories, expression (R-8)

II. Word Attack

Sight vocabulary (R-9)

Rhyming words (R-10)

Phonetic analysis (R-11)

Structural analysis: plurals, possessives, root words (R-12)

II. Comprehension

Picture clues (R-13)

Main idea (R-14)

Details (R-15)

Sequence (R-16)

Context clues (R-17)

Following directions (R-18)

Reading Objectives
page two

II. Comprehension (continued)

Drawing conclusions (R-19)

Predicting outcomes (R-20)

Classifying (R-21)

Cause and effect (R-22)

IV. Interpretive Skills

Dramatization (R-23)

Appreciation of different types of literature (R-24)

Critical reading (R-25)

Critical thinking skills (R-26)

V. Study Skills

Picture dictionaries (R-27)

Use and care of books (R-28)

Use of library (R-29)

MATHEMATICS OBJECTIVES
FIRST GRADE PROJECT 1976-77

I. Mathematics Readiness Skills

Vocabulary (e. g. many, few, large, small, up, down, on, beside, etc.) (M-1)

Sorting objects on the basis of color, size, and shape (M-2)

Sequencing shapes, patterns, and events (M-3)

Comparison of objects in terms of size: larger, smaller, same size as (M-4)

Identification of sets (M-5)

One-to-one correspondence between sets (M-6)

Equivalent and non-equivalent sets (M-7)

Empty set (M-8)

Cardinal numbers of sets with 0 to 10 members (M-9)

II. Numeral Identification, Counting, and Comparison of Numbers

Counting from 0 to 10 (M-10)

Writing numerals from 0 to 10 (M-11)

Number line (M-12)

Knowledge of ordinal numbers and words from first (1st) to fifth (5th) (M-13)

Place value: ones (M-14)

Concepts of "is greater than" and "is less than" with symbols (> , <) (M-15)

Comparing and ordering numbers: 0 to 10 (M-16)

Recognition of words for numbers: 0 to 10 (M-17)

Writing words for numbers: 0 to 10 (M-18)

Place value: tens (M-19)

Counting from 10 to 50 (M-20)

Writing numerals: 10 to 50 (M-21)

Mathematics Objectives
page two

II. Numeral Identification, Counting, and Comparison of Numbers (continued)

Comparing and ordering numbers: 10 to 50 (M-22)

Knowledge of ordinal numbers and words from sixth (6th) to tenth (10th) (M-23)

Place value: some exposure to expanded notation with numbers to 100 (e. g. 87 = 80 + 7) (M-24)

Counting by twos, fives, and tens (M-25)

Counting from 50 to 100 (M-26)

Writing numerals: 50 to 100 (M-27)

Comparing and ordering numbers: 50 to 100 (M-28)

Concept of even and odd numbers (M-29)

Concept of 1/2, 1/3, 1/4 (no written symbols) (M-30)

III. Computation: Addition

Joining sets (M-31)

Addition vocabulary and symbols (e. g. put together, add, sum, join, addend, +, =, etc.) (M-32)

Sums to 18: open sentences, or horizontal format (e. g. 3 + 4 = ▱) (M-33)

Sums to 18: vertical format (M-34)

Addition of three one-digit numbers: with regrouping and horizontal format (M-35)

Addition of three one-digit numbers: with regrouping and vertical format (M-36)

Addition of two-digit number (multiple of 10 and less than 100) and a one-digit number: vertical format (e. g. $\begin{array}{r} 20 \\ +7 \\ \hline 27 \end{array}$) (M-37)

Addition of two two-digit numbers: no regrouping, vertical format (M-38)

Mathematics Objectives
Page three

IV. Computation: Subtraction

Subtraction vocabulary (e. g. subtract, minus, -, =, etc.) (M-39)

Minuends to 18: open sentences or horizontal format (e. g. 7-3 = ▱) (M-40)

Minuends to 18: vertical format (M-41)

Open sentences, missing addend (e. g. 3 + ▱ = 7) (M-42)

Subtraction of a two-digit number from a two-digit number: no regrouping, vertical format (M-43)

V. Application

Some exposure to simple oral story problems involving addition (M-44)

Some exposure to simple oral story problems involving subtraction (M-45)

VI. Measurement

Money symbols: penny, nickel, dime, quarter (M-46)

Money value: penny (1¢), nickel (5¢), dime (10¢), quarter (25¢) (M-47)

Relationship between penny, nickel, dime, and quarter (M-48)

Time to hour and half-hour (M-49)

Non-standard linear and liquid measurement (M-50)

Some exposure to standard linear and liquid measurement: inch, cup, pint, quart (M-51)

Calendar: days of the week (M-52)

Calendar: exposure to months (M-53)

VII. Elementary Geometry

Closed and open curves (M-54)

Inside, outside, and on a closed curve (M-55)

Shapes: square, triangle, rectangle, circle (M-56)

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VIII. Graph Interpretation

Picture graphs (M-57)

Bar graphs (M-58)

APPENDIX F

List of Symbols

LIST OF SYMBOLS

Symbol	Definition
x^2	Chi-square
p	Probability
n	Sample Size
M	Mean
df	Degrees of Freedom
SS	Sum of Squares
MS	Mean Square
F	F-ratio